THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1911 EDITION

H. ALABASTER, GATEHOUSE & CO.,

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YOU ARE WANTED—IN CHINA!

ELSEWHERE in this issue we publish two important messages that have come to hand by this week's mail from China. Written by men who are "on the spot," in the midst of the very real foreign activity to which they refer, they merit—nay, demand—the immediate attention of every British electrical manufacturer and exporter. Several years ago we placed before our readers the whole subject of the future of China as a field calling for the closest study and enterprising effort. Already our rivals were on the ground, and it was necessary to set to work immediately and in earnest unless we were to be for ever at a disadvantage. What has happened since? News has filtered through from other countries of deeply-laid schemes for the expenditure of any amount of money in securing a firm electrical foothold and immovably establishing it. From our two contributors in China comes the story of how these schemes are progressing. But what of British deeply-laid schemes—where are they? Here are we still being told as we have been told a hundred times—these foreigners prefer to have British manufactures—*if they can get them!* We are at an advantage so far as reputation and esteem are concerned; our old name may still stand us in good stead; but we are so utterly callous as to that essential thing, competent skilled-engineer-trader linguistically equipped representation, that we practically *compel* the Chinese to give their business to our competitors. We are to blame for our own loss! We improve the already excellent chances of our foreign competitors in competition with us both at home and in Colonial and other markets by in China tickling their German ribs with a feather the while they wield a competitive sword. Is this too strong a language? Let everybody read the present additions to the surfeit of warnings and advice given by authorities and quoted in British journals such as this, and judge for himself whether what we now say be not more than justified.

One of the writers presses home the necessity for having our qualified agents constantly moving about in the Interior. China is not like England or the Colonies, where contracts or concessions are frequently advertised for tender. It is necessary to be there in order both to hear of the business and to secure it. It may be said that few British electrical firms are able to stand the expense: that independent efforts of a number of us in competition simply means incurring the expense in a modest sort of a way many times over: that German and American concerns having larger organisations and more generous financial support, will do by one combined effort of a number of representatives of one works far better than the suspicious unco-operative effort of half-a-dozen or a dozen scattered English efforts lacking in general policy and principle, and therefore all of them, both individually and collectively, weaker than a German or American joint effort. The ability and responsibility for deciding

if all this be true or not, lie with the heads of British electrical firms. There have been visits to other parts of the world which have paid so well that representatives have been sent to settle there, though not perhaps on the same scale as seems to be required if we are to secure China as an outlet for our manufactures. Those foreign efforts have improved the position of the firms that made them, and if they were in a position to make those efforts they should now be equal to a great attempt in China. But assuming it be correct that individual efforts in China are too costly for many of us, why not let the heads of half-a-dozen or a dozen manufacturing businesses confer, conceive a scheme on ambitious lines, pool the expenses, British firm "A" taking all boilers and incidental line orders that are secured, "B" the engines or turbines, "C" the dynamos or motors or both, "D" the switchgear, "E" a number of the other classes of manufactures, until the whole circle embodying "Everything Electrical" be covered in one organisation? This done on ambitious lines, each firm being prepared with a liberal share of financial support, there should be every chance of a successful British co-operative competition against German or American organisations which are always at a certain disadvantage, because they are not *British*. The large firms who are enterprising and strong enough to cover the ground alone will find it worth doing, for the field is a very large one and promises to afford a very fruitful soil. Why should we not reap as good a harvest as any?—but we remember that in the old parable it was *while men slept* that an enemy came. If we wish the vast territories of China—with her 400 millions of population, all of whom, as Western civilisation continues to make progress among them, will have multifarious new needs calling into existence multitudinous demands for new industries, new factories, requiring the service of electricity—to be sown with foreign electrical seed which it will be difficult to remove in years to come, we may continue to slumber. But if we seriously desire to secure a fair share of the trade of this enormous market, where the prospect for electrical business is now said to be as good as it was in this country 12 years ago, prompt and full action is imperative.

We are simply playing into our rivals' hands unless we as British electrical manufacturers set our house in order at once and send the right men out to China before many weeks are past. The call is an urgent one. We pass it on. We will not again now enter into all the different questions raised in these two articles—we simply crave for them the closest reading, the most serious thought, that it is possible to give. It is for the manufacturer and the exporter to see that the opportunity is not entirely lost; also is it for the commercial-engineer or engineer-trader to learn the German and the Chinese game, to polish up his knowledge of German, and learn the lingo of the Chinaman and be prepared to go. Last week we saw how the German, going to South America, leaves all behind, works on from early morn to dewy eve, and does not permit the thoughts of home to persuade him from the task which has been set. For him business is business; he succeeds, and having succeeded returns. We are not all built that way—we are not all wanted to go—but there are scores of not over-young experienced Englishmen or Scotsmen without hindering ties who would be in their element when waging the great commercial warfare in China if the reward for so doing were at all commensurate with the effort, and if they knew that they might be benefiting British electrical and engineering industries for a decade to come. Will not the British manufacturer give them a chance?

THE ELECTRICAL TRADES BENEVOLENT FUND.

The proceedings at the annual meeting of the Electrical Trades Benevolent Institution, held in London last week, possess a special interest, inasmuch as having completed five years' existence it will now devolve upon it, in accordance with the Rules, to grant pensions. Already much good work has been done. First, it is something to have established the Institution; next, and better, it has accumulated a few thousand pounds; and in the everyday working of the Association cases requiring immediate and temporary help have received considerate treatment at the hands of the Committee. The organisation necessary for the setting-up and working of such an Institution cannot be started without initial expenses being incurred. Those who have had anything to do with the preliminary matters of the last few years will know what an enormous amount of work has fallen upon those who have generously devoted themselves to the setting-up of the necessary machinery required for conducting the affairs of the Fund on perfectly sound lines. It has been pioneering work, the benefit of which will be felt by hundreds, perhaps thousands, in years to come, as long as the Fund shall last. It may be that some who have studied the balance-sheet for 1910, which appeared in our issue of March 24th, have considered that the amount of the claims met was small compared with the outgoings—or working expenses. What we have just said must be borne in mind in this connection. The expenses are attendant on the "building up" process, and as claims become larger, expenses will not be in the same proportion, though it is reasonable to hope that for many years to come there will be a good round sum to be annually added to the invested funds. How important it is that this should be so was impressed upon last week's meeting by Mr. Justus Eck, who, right from the beginning has devoted himself ungrudgingly to this object. Mr. Eck, and, indeed, everybody else present, recognises that if the Fund is to be in a position to meet the Pension responsibility there must be a very large increase in its capital. No one would be a party to granting pensions without there being ample security for continuing their payment. How many can it grant from the interest on a capital of between £2,000 and £3,000? It is, therefore, greatly to be hoped that much-needed support will now be forthcoming from those whose interest has not yet been secured, among them being what we understand as the "large" undertakings—large manufacturing and selling concerns, as well as users of electricity on a large scale.

It will probably happen that a decision arrived at last week will go some distance toward securing a more general assistance in the matter of subscriptions, and simultaneously influence those who are able to give donations. It is no secret that many questions such as this have been asked:

"Who is entitled to benefit from the Fund?" In the early stages a general clause was adopted which read thus :—

The object of the Institution is to grant pensions and to dispense temporary relief to deserving and necessitous persons who are, or have been, engaged in the electrical trade in the United Kingdom, or to their widows and families.

The wording here is, of course, too general and indefinite, a kind of weakness which, as it leaves men in doubt as to whether their own particular vocation is intended to be covered, is calculated to restrain subscribers of a certain class. The Benevolent Institution is not a benefit society in the ordinary acceptance of that term, yet it is indisputably true that if we are to have the support of the rank and file of the electrical trades, there must be a feeling that the subscriber if he fall on evil times will have a claim for consideration. In order to secure the co-operation of some such as subscribers, and of their employers as donors or legators, the rule has now been amended and amplified as follows :—

The objects of the Institution are to grant pensions and to dispense temporary relief to deserving and necessitous persons, who are, or have been, engaged in the electrical trade in the United Kingdom, as employers, managers, teachers, or on the engineering, designing, drawing, sales or office staff, or persons in any other capacity that the Committee may regard as bringing them within the scope of the Fund.

It seems to us that this should at once convey a sufficiently definite idea to set most minds at rest, while not too rigidly limiting the discretion of the Committee, and we trust that the suggestion which has already been made in these pages, and which was expressed again last week, that an effort be made in electrical business houses to secure the assistance of honorary stewards or collectors from among employés who will regularly obtain small sums from the latter, and thus widen the interest in the Fund without widening its scope beyond the intention as expressed in the amended rule quoted above, will meet with support on all sides.

Coronation Transparencies.—While we are generally content with pictorial representations of the decorations proposed by manufacturers for the coming festivities, in the case of Messrs. John W. Mackay & Co., of 1-3, Alexandra Buildings, Finsbury Park, N., we have been favoured with a view of some of the actual transparencies which that firm has prepared. These are printed by a special patented process which gives bold outlines while preserving really good likenesses of the King and Queen, and the prints are afterwards coloured by hand with transparent oil paints, the result being an effective and pleasing picture by day as well as by night. The portraits are on canvas or holland, and are perfectly weatherproof, while they have the additional advantage, appropriate to the occasion, that the process, materials and work are all British. As they are coloured by hand, those who intend to stock these transparencies are advised to place their orders early. A variety of sizes is made, both plain and coloured.

Westinghouse Turbines.—The British Westinghouse Electric and Manufacturing Co., Ltd., report great activity in their steam-turbine department, the output of these machines during 1910 aggregating 100,000 h.p., a figure considerably over double that of the previous 12 months. The success which has attended the manufacture of their impulse turbines is shown by the fact that for the first three months of this year the company received orders for 22 turbines aggregating 40,000 h.p., equivalent to an increase of nearly 60 per cent. on the figure for the corresponding period of last year.

Allahabad Exhibition.—At this Exhibition, Messrs. Balmer, Lawrie & Co., of Calcutta, agents for Messrs. Ernest Scott and Mountain, Ltd., received a gold medal for exhibits of portable three-throw ram pumps with three-phase motors, and for portable main rope haulage gears, the medal being awarded for general excellence of design.

Candle Fittings.—The "Kingolite" Co., of Wardour Street, W., have supplied their "Kingolite" fittings to the following : Buckingham Palace, Holyrood Palace, the Royal Pavilion at Aldershot, and the steamships *Olympic* and *Titanic*.

THE RISE IN TEMPERATURE OF ELECTRICAL APPARATUS.

By F. BACON, M.A., A.M.I.E.E.

In the Electrical Review of December 16th last a correspondent raised some questions in connection with heat, which were dealt with in an editorial column of the same number. The same correspondent raised some further questions in the issue of January 13th. Since the subject touched on is admittedly of great importance, and erroneous views are only too prevalent, a more detailed discussion of the laws governing the rise in temperature of electrical apparatus may not be out of place.

The same simple test case dealt with in the correspondence referred to above will serve our purpose. We were asked to consider two hollow cubes of metal, both of exactly the same external dimensions and the same in every respect except that cube No. 1 has thicker walls than cube No. 2, so that the former will weigh three times as much as the latter cube. Similar electric heaters are arranged in the centres of the cubes, and precautions are taken which ensure that the transmission of heat to the interior walls of the cubes is identical in quantity and distribution, and that the nature of the external surfaces and surroundings of the two cubes is also identical, so that the conditions under which heat is dissipated are the same in every respect for each cube. Let the edges of each cube measure 1 ft. and let the walls of cube No. 1 be 2 in. thick. Then it will be found that in order that cube No. 2 may contain only one-third the material, its walls must be approximately $\frac{1}{2}$ in. thick. If both the cubes be made of iron of specific gravity 7·7, the weights are approximately 150 kg. and 50 kg. respectively. Taking the specific heat of the iron to be 0·11, it follows that the quantities of heat necessary to raise the temperatures of the cubes 1° C. are 16·5 kg. calories and 5·5 kg. calories respectively; or since 1 kg. calorie = 70 watt-minutes, these two heat capacities may be written 1,155 watt-minutes and 385 watt-minutes respectively.

Now, suppose electrical energy is supplied to both heaters at the rate of 864 watts. At first all the energy supplied will be used in heating up the metal, the times taken to raise the temperature 1° C. being 1,155/864=1·35 minutes and 385/864 = 0·45 minute respectively, so if we plot curves of temperature-rise against time, measured from the instant of switching on the heating current, the commencement of these curves must be the lines O T_1, O T_2 (see fig. 1),

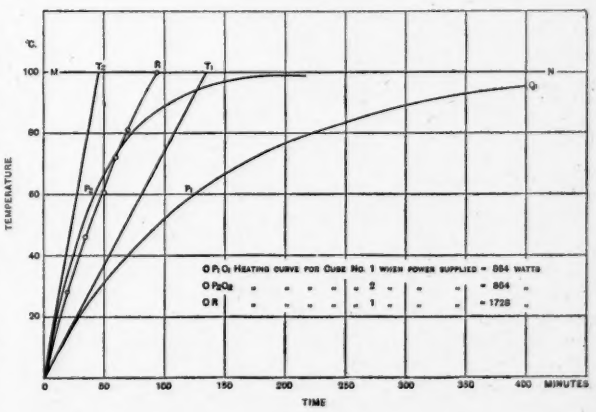


Fig. 1.

drawn so that their slopes represent these rates. But as soon as the temperature of either of the cubes—say No. 1—rises above that of the surrounding air, heat will begin to be dissipated from the external surface. Provided the temperature rise is moderate in amount, it is fairly accurate to assume Newton's law of cooling, viz., that the amount of heat dissipated from a hot surface is proportional to the difference between the temperatures of the surface and of the unheated surrounding air. As the temperature of the cube rises above that of the surrounding air, heat is dissipated at

an increasing rate proportional at any moment to the difference in temperature then existing. A temperature of equilibrium is ultimately attained at which heat is dissipated from the outer walls of the cube as fast as it is communicated to the inner walls. Since the superficial area of either cube is 864 sq. in., we shall then have 1 watt dissipated per square inch of hot surface. It would be unwise to attempt to predict with accuracy the temperature-rise necessary to produce this rate of dissipation without data obtained from experiments in which all the conditions were strictly comparable; but from data in common use for estimating the temperature rise of stationary field coils, it is probable that the temperature rise of the metal would be of the order of 100° C. Without claiming any accuracy for this figure, we will adopt it as being a possible and convenient temperature rise for illustrating the fundamental principles involved. Then the final part of our heating curve must gradually approach the horizontal line M N drawn at a temperature of 100° C.

At any intermediate temperature rise, *e.g.*, 60° C., the rate of heat dissipation will be only 0·6 times that occurring at 100° C., *i.e.*, 0·6 times the rate at which heat is being supplied, so that the balance of 0·4 times the watts given out by the heater is expended in heating up the mass of iron. Hence the slope of our heating curve at this temperature must be only 0·4 times as steep as the line O T_1 at starting when all the heat given out by the heater was expended in heating up the metal.

Enough has now been said to make it evident that our heating curve must be such that the tangent at any point must be proportional to the vertical distance of the point below the line M N. It is easy to obtain mathematically a logarithmic equation for a curve possessing this geometrical property, and curve O P_1 Q_1 has been constructed by calculating points by means of such an equation. A single curve of this kind drawn once and for all will suffice for all other cases by simply adapting the scales to suit the conditions. The scale of temperature must be such that M N always represents the ultimate temperature of equilibrium, and the scale of time must be so selected that, in conjunction with the scale of temperature just determined, the slope of the tangent O T correctly represents the initial rate of heating, or what is the same thing, the scale of time must be such that the abscissa of the point T represents the time taken for the heater to supply enough energy to raise the temperature of the cube to the ultimate equilibrium temperature supposing no heat were dissipated during the process. From the calculations already made, it appears that for cube No. 1 this time is 135 minutes, and for cube No. 2 it is 45 minutes.

If we wish to convert the curve O P_1 Q_1 into a heating curve for cube No. 2, all that is necessary is to interpret the scale of time so that 300 minutes for cube No. 1 becomes 100 minutes for cube No. 2, and proportionally for other numbers, the scale of temperature remaining the same in both cases, since both cubes will ultimately attain a temperature of 100° C.

If now the heating current were increased so that the power supplied was 1,728 watts, or twice as great as before, the ultimate temperature would be 200° C., so all the figures on our scale of temperature must now be multiplied by two: but in this case the scale of time remains as at first, for M N must still represent 135 minutes, since although heat is now being supplied twice as fast, twice the quantity of heat has got to be supplied before the temperature difference will rise to its ultimate value of 200° C.

Instead of using one curve for all cases, as explained above, we have, in order to facilitate comparisons, kept the scales the same throughout, and replotted the heating curves, so that O P_2 Q_2 represents the heating curve for cube No. 2, and O R represents the first part of the heating curve up to 100° C. for cube No. 1 when the heater supplies 1,728 watts instead of 864 watts, as in the case of curve O P_1 Q_1.

It is interesting to examine how very much more rapidly the heating-up takes place when the heater supplies energy at increased rates. We have already seen that when energy is supplied to cube No. 1 at the rate of 864 watts, an ultimate steady temperature rise of 100° C. will only be attained after an indefinitely long period, though we find from curve O P_1 Q_1, fig. 1, that a temperature rise of 90° C. will be reached in 315 minutes and a temperature rise of 80° C. in 220 minutes. If, however, energy be supplied to cube No. 1 at the rate of 1,728 watts, it only takes 94 minutes to produce a temperature rise of 100° C., and heating takes place at a fairly constant rate throughout, as shown by the comparative straightness of the curve O R. If energy were supplied at some other rate—say, 1,000 watts—adhering to the old assumptions as regards cooling, the ultimate temperature rise, if allowed to take place, would be (1,000/864) × 100° C. = 116° C., while the time taken to attain this temperature, supposing no heat were dissipated, would still be 135 minutes. So to adapt curve O P_1 Q_1 to the new conditions, we multiply the figures of the temperature scale in fig. 1 by 1·16, but retain the time scale unaltered. Reading off at a temperature rise of 100° C. (100°/1·16 = 86° on the old scale), we find the time taken is 270 minutes.

If the object in view is to heat the metal, we can also calculate the efficiency of the heating process, for the total amount of energy expended is 1,000 × 270 = 270,000 watt-minutes, while the amount of heat stored in the cube is only 115,500 watt-minutes (= 1·925 KW.-hours). Hence the efficiency of heating is $\frac{115,500}{270,000} \times 100 = 42{\cdot}8$ per cent., the remaining 57·2 per cent. being dissipated during the process of heating. By making a number of similar calculations for different rates of heating and plotting the results obtained, the curves in fig. 2 have been constructed, which show clearly how much is gained in time and saved in energy by supplying energy at a rapid rate.

Let us now pass on to the consideration of what happens when the load is intermittent. For instance, we may imagine that the cubes Nos. 1 and 2, with their internal heaters, constitute embedded resistances for controlling a

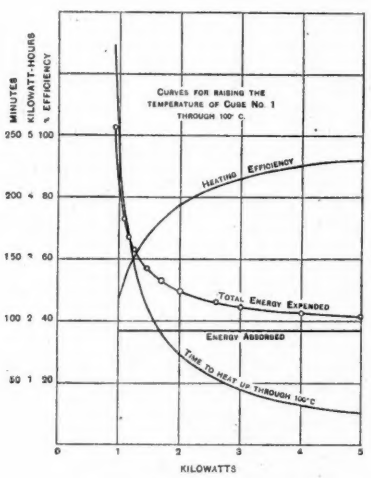


FIG. 2.

motor which operates a lift, so that every period of heating is followed by a period of rest sufficiently long for an appreciable amount of cooling to take place.

To analyse this problem, the *cooling* curve must first be constructed. Suppose cube No. 1 to be heated up by the expenditure of energy at the rate of 864 watts until the ultimate temperature rise of 100° C. is attained. If the heating current is now interrupted, cooling will begin to take place at precisely the same rate (viz., 864 watts) as heating originally commenced at when the heating current was first switched on, so the tangent to the cooling curve M T_1^1 (fig. 3) is inclined at the same angle as the tangent O T_1 of the heating curve. When the temperature has fallen, say to P_1^1, 40° C. above the air temperature, cooling will take place at 40/100 times the initial rate, which corresponds in every respect to the rate of heating found at P_1 on the heating curve when the temperature was 60° C. Thus, it appears that the cooling curve M_1 P_1^1 Q_1^1 is really the same as the heating curve O P_1 Q_1 swung round about the horizontal line drawn at 50° C. as an axis.

Suppose now that each period of heating at the rate of 864 watts lasts for 25 minutes, and is followed by a period

of cooling of equal duration, so that the load factor is 50 per cent. The temperature will mount along the heating curve to p_1, then it will fall along a portion of the cooling curve to p_1^1, then it mounts to p_2 following another portion of the heating curve and so on, until finally the successive heatings and coolings both take place between the same limits of temperature. The smooth curve o p_0 represents the rise of

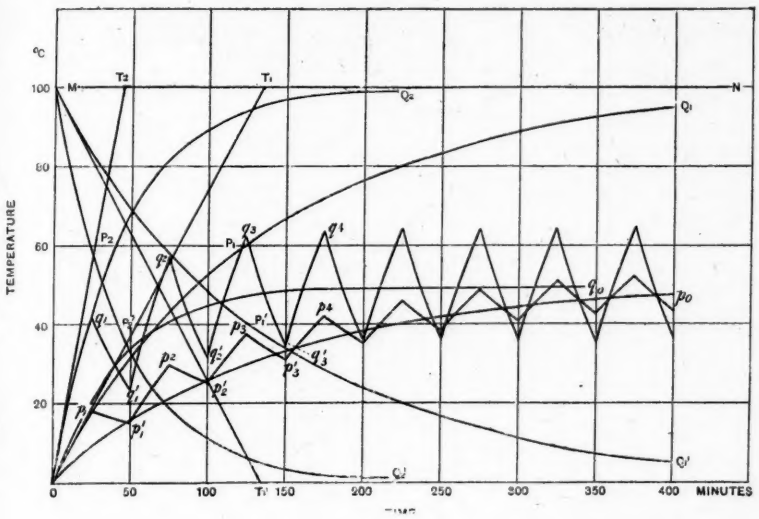


Fig. 3.

temperature supposing power were expended continuously at the rate of 432 watts, instead of at 864 watts with a load factor of 50 per cent.

The zig-zag curve o q_1 q_1^1 q_2 q_2^1 q_3, and the smooth curve o q_0, apply to cube No. 2 when heated correspondingly. It will be noticed that although the ultimate mean temperature rise for either cube is 50° C., the lighter cube, No. 2, heats up three times as fast as No. 1, and is subjected to much wider fluctuations of temperature. It is obvious that in many cases of short-time service such as occur in starting resistances, cube No. 1 might prove satisfactory, while cube No. 2 would be much more liable to burn out. At the end of the second heating operation, for example, cube No. 2 would attain a temperature rise of 56° C., while the corresponding temperature rise for cube No. 1 would only be 30° C. If, on the other hand, the cubes are to work intermittently for indefinitely long periods, the only advantage possessed by the heavier cube is that due to smaller fluctuations of temperature, and in practical cases these are likely to be of small importance. For the sake of clearness we took a long interval of 25 minutes for the periods of heating and cooling, but intervals of one minute would be more in accordance with actual conditions, and in sustained intermittent service of this kind in which starting and stopping follow each other in rapid succession, the zig-zag heating curves will flatten down until they closely approximate to the smooth curves o p_0, o q_0, in which case—so far as heating is concerned—there is nothing to choose between the two cubes, for the maximum ultimate temperature is then practically decided by the amount of cooling surface alone, and is independent of the heat capacity.

Suppose, however, that according to common practice the specified shop test consisted of successful continuous operation at 864 watts for 1 hour. For cube No. 2 this would be a most stringent test, for, as seen from curve o P_2 Q_2, it would involve a final temperature rise of 73° C., or a temperature rise nearly 50 per cent. greater than the 50° C. rise attained under working conditions. In the case of cube No. 1, however, the test would be quite inadequate, for referring to curve o P_1 Q_1, the temperature rise at the end of one hour's run would be only 36° C., or 72 per cent. of the temperature rise attained under working conditions. For further information on the unsatisfactory nature of short-time tests for machinery intended for intermittent working the reader should consult a paper by Dr. R. Pohl read before the Inst.E.E. in March, 1910.

In all that has been said above, we have supposed a uniform temperature to exist in all parts of the cubes under consideration. Before concluding, it should be pointed out that, in reality, under all conditions of heating and cooling, different temperatures must exist in different parts of any such apparatus. Heat flow within the metal can only be set up and maintained by virtue of the existence of a temperature gradient in the direction of flow. In the present instance, the differences of temperature existing from this cause will be of small account, for the conductivity of iron is such that a temperature gradient of somewhat less than 1° C. per in. is all that is required to maintain a heat flow of 1 watt per sq. in. Thus, although the temperature of the inside faces of the thicker walled cube No. 1 must be higher than the corresponding temperature of cube No. 2, an excess of 1° or 2° C. will suffice.

It should be remembered also that the heat-dissipating qualities of the six faces of either cube will not be identical, and differences of temperature will also exist from this cause. Supposing two of the faces of a cube to be horizontal, the upper face will be most favourably situated for dissipating heat, since the heated air can rise freely. At the under surface, the temperature of the adjacent air will rise considerably, but there will be no free circulation to enable this heated air to be replaced by air that has not yet been heated, with the result that the heat-dissipating power will be markedly impaired. The cooling effect on the four vertical walls will be intermediate between those of the upper and lower horizontal faces. Some experiments made by the author on a hollow 18-in. cube showed that if 100 denote the rate of heat dissipation from either of the vertical sides, the rates of dissipation from the upper and lower horizontal faces would be of the order of 130 and 70 respectively.

STEEL CHIMNEYS.

By K. TROWBRIDGE.

The use of smoke stacks built up of wrought-iron or mild-steel plates riveted together has become very general practice in this country, chimneys of heights varying from 50 to 300 ft. being already in successful operation; a few notes on their characteristics and design may therefore be acceptable.

Such disadvantages as are possessed by this construction are wholly outweighed by compensating conveniences and economies. The ugly parallel sheet-metal chimney supported by widespread guy ropes is already a thing of the past, so far as new erections are concerned, and there is no reason why a well-designed steel chimney without guy ropes should not be as safe and as æsthetic as the finest brick stack, while possessing the additional advantages of cheapness, lightness, and rapidity of construction.

A steel chimney will usually cost no more than half as much as the equivalent brick chimney, being far cheaper in both material and labour. For heights varying from 50 to 200 ft., steel chimneys have been erected at a total cost averaging £2 to £3 per foot. As for rapidity of construction, a 100-ft. steel stack may be erected, from start to finish, in less than a month—a result which it would be impossible to approach in any brick structure. A pleasing appearance and avoidance of guy ropes are simultaneously attained by a bellying of the base of the shaft (see fig. 1), while the use of a wrought-iron or cast-iron headpiece replaces the usual brick coping and relieves the ugliness of a plain parallel finish. The bellied bottom of the shaft is bolted to a heavy cast-iron foundation plate laid on 1 ft. to 3 ft. of concrete. It will then generally be found that the chimney will resist the strongest probable wind pressure (say, 55 lb. per sq. ft.) without the resultant of the lateral pressure and the downward weight passing outside the base of the chimney

(or, at least, without its approaching too closely the edge of the foundation plate). If this be not the case, the weight of the foundation structure must be suitably increased.

The use of the plate thicknesses suggested below will usually secure a sufficiently stiff chimney, and in any case the use of metal plates and riveted joints involves the advantage that the strength of the final structure can be more accurately predicted than is the case with brick chimneys; in other words, a lower factor of safety suffices in the former instance.

The wind surface exposed by a steel chimney for a given effective flue area is less than would be offered by a brick shaft of equal internal bore—a fact further tending towards light construction. Again, a steel chimney is immune from such serious damage as may be inflicted on brick stacks by lightning, and there is no reason why a lightning conductor should be fitted to the former. The avoidance of guy ropes is a matter of considerable importance in this connection, since these ropes, wide-spread from the top of a chimney, may lead lightning discharges into dangerous places, in spite of the metallic path offered by the chimney itself; even

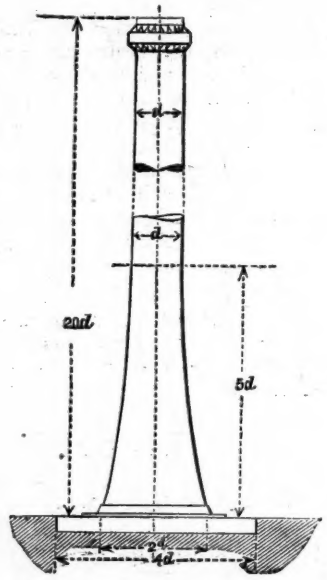


Fig. 1.

when the latter is provided with a "conductor," all danger from this source is not removed. It has been suggested that the magnetic properties of steel chimneys might impede the conduction of lightning discharges; it is doubtful whether this action would be appreciable, but it would certainly be well to provide conductors on the old guyed type of stack.

The most general complaint against steel chimneys is, probably, the rapidity of their corrosion, but it will be found that several coats of good red-lead paint, applied once in from one to three years, will keep the stack in excellent condition and cost no more than the continual attention which must be paid to large brick chimneys. By building an iron ladder up one side of the stack and fixing cradle-suspending pulleys to the top of the latter, subsequent inspection and maintenance is greatly facilitated.

Internal corrosion and overheating is prevented by a fire-brick lining extending half to two-thirds the height of the stack: such a lining also prevents any tendency to too rapid cooling of the gases and consequent reduced intensity of draught. It need hardly be mentioned that there is no reason why any leakage should occur from the flanks of a metal smoke-stack at any part of its height.

Corrosion of metal chimneys, where it occurs, is mainly due to sulphurous fumes in the flue gases, and so powerful may be the corrosive action of the latter that it is worth while considering it in detail. Many coals, particularly of inferior grade, contain a considerable percentage of sulphur which, on the combustion of the coal, forms sulphur-dioxide thus:—

$$S + O_2 = SO_2. \quad \ldots \quad \ldots \quad (1)$$

Now the moisture in coal is dissociated, at the high temperatures reached in the boiler furnace, yielding hydrogen and oxygen thus:—

$$2\ H_2O = 2\ H_2 + O_2. \quad \ldots \quad \ldots \quad (2)$$

With the oxygen thus liberated, the sulphur-dioxide of (1) combines to form trioxide:—

$$2\ SO_2 + O_2 = 2\ SO_3; \quad \ldots \quad \ldots \quad (3)$$

and finally, water vapour combines with the latter gas to form sulphuric acid:—

$$H_2O + SO_3 = H_2SO_4; \quad \ldots \quad (4)$$

and the corrosive action of sulphuric acid on all metals is well known.

That this action does actually occur is conclusively proved by the fact that some moisture collected from near the top of a metal chimney stack showed acidity = $\frac{1}{20}$th normal sulphuric acid! It is not surprising that this particular chimney lasted only two years. The importance of frequent inspection, of careful painting when and where necessary, and of heavily penalising the sulphur content of coal in drawing up contracts, is very evident.

A sulphurous coal is no less deleterious to the boiler and economiser tubes, and, in fact, to all metals with which it comes in contact. Though sulphuric acid can hardly form till the flue gases have got beyond the high temperature zone of the furnace, there has actually been found, on boiler tubes exposed to the hottest part of the flames, yellow iron-sulphate, formed as follows:—

$$Fe_2O_3 + 3\ SO_3 = Fe_2(SO_4)_3; \quad \ldots \quad \ldots \quad (5)$$

iron rust + sulphur-trioxide = yellow iron-sulphate.

Constructional Notes.—No plates thinner than $\frac{1}{3}$ in. should be used in steel chimneys, and, as the cost of erection is much the same for heavier plates, it is advisable, for safety and long life, to err somewhat on the side of thicker sheets.

For the top section of a steel-plate chimney, $\frac{5}{16}$-in. plates may well be used and continued down for 35 to 40 ft., when the thickness should be increased to $\frac{3}{8}$ in., and continued thus—

To 65—70 ft. from the top, and then increased to $\frac{7}{16}$ in.
„ 90—100 ft. „ „ „ „ $\frac{1}{2}$ in.
„ 110—120 ft. „ „ „ „ $\frac{9}{16}$ in.

Lap riveting is usually employed, a single line of rivets sufficing near the top of the chimney, and double or treble rows being advisable near the bottom. The lines of rivets should, of course, be staggered round the chimney so as to make the finished structure equally stiff to lateral forces in every direction.

Suitable leading proportions for steel plate stacks are shown in fig. 1, in terms of the parallel bore of the flue above the bellying.

Weight.—It is an easy matter to estimate the approximate weight of a steel stack from the number of square feet of plates of various thicknesses employed in its construction; the weight of the plates alone may be estimated from the rules given below, while an addition of 5 per cent. should fully cover the weight of overlap, rivets, &c. The weight of the foundation plate is determined by conditions of stability as above, and the weight of the brick lining must be separately estimated, this part of the structure being credited with little, if any, mechanical strength.

Suppose h_1 ft. (height) of the chimney be built of t_1 in. plate,
and h_2 „ „ „ t_2 „
h_3 „ „ „ t_3 „
and so on, then the mean thickness of plate, for present purposes = t in. =

$$\frac{h_1 t_1 + h_2 t_2 + h_3 t_3 + \ldots}{H},$$

where $H = h_1 + h_2 + h_3 + \ldots$ = total height of chimney (ft.)
$= x \,.\, d$ (say),
where d = diameter of parallel bore of chimney (ft.).

Let the base diameter of the stack = $2d$ ft. (see fig. 1), and let this be uniformly tapered up to d ft. in a rise of h ft., where $h = y \,.\, d$ ($y = 5$, in fig. 1), then the mean diameter for present purposes = D =

$$\frac{(x + 0{\cdot}5\ y)\ d}{x} \text{ ft.}$$

and the approximate weight of plates contained

$= \pi \times$ mean diam. $\times$ mean thickness $\times$ height $\times$ density
$= 126{\cdot}5$ D. t. H lb.
$= 0{\cdot}0565$ D. t. H tons; ... ... (6)

to which add 5 per cent. for rivets and overlap, &c. The weight of the brickwork lining = 2 to 3 × that of the plates, and the foundation casting is separately designed as above.

BOOKS AND RECORDS FOR SUPPLY STATIONS.

By "RECORDER."

No one system of books will meet the requirements of all supply stations, particularly where they vary in size, for large stations need an amount of elaboration which their smaller neighbours cannot afford—indeed, the smaller fry may depend on the memories of the staff in a way impossible to the big suppliers. Nevertheless, even small stations are all the better for a good deal of system, provided that it is not too expensive to run. The methods outlined below have been found useful over a period of years in a works of medium output, and they may, therefore, be of interest to some readers.

Consumers' Register.—To keep every meter on consumers' premises properly in sight must always be a matter of some difficulty. Unhappily—and it would seem unavoidably—electricity supply is cursed with a multiplicity of meters. One price is charged for lighting, another for power, and a third for heat, and every rate needs a separate meter. Sub-meters provide a new terror, being located in places so unexpected as to try the patience of the most uncomplaining of meter readers. It is quite possible for some readings to be missed—indeed, the possibility has been known to become an actuality, to the tribulation of the chief, as may be learnt in the course of very private and confidential talks. Especially may meters be overlooked when they have been out of use for a long period. Someone has a radiator which has been disconnected, but the meter is left up, or premises have been tenantless for a long time, and the reader has got into the habit of passing by on the other side. Then some day it is found that the fuse has been put in, and that current has been passing through and a large number of units have been registered for which no accounts have been presented. It is very awkward to know what to do. To send in an account for the whole reading is to confess that the meter has escaped attention, while provoking in addition a storm from the wrathful consumer enraged at the unexpected and large account. He, of course, should be thankful for having had for a long time the use of money which ought properly to have been handed over to the station, but he is not. Usually he threatens to expose the electricity staff to the censure of the town, a censure really due to himself for his not having informed the station that he was using the meter again, while he lashes himself into a fury and the belief that he is a much afflicted man. Probably the matter is allowed to drop, but even this is not satisfactory. The method here described provides reasonable safeguards from such troubles, while it has the advantage of checking errors which easily occur, particularly when a number of responsible members of the staff leave and are replaced by more or less inexperienced men. In this method every application, as it comes to hand, is entered into the consumer's book, and every meter is treated as if it were an additional consumer. Each line in the consumer's book is numbered, so that a separate number is given to each meter. The entries appear as follows :—

100. J. Smith, 2, Green Street.
101. P. Jones, 18, White Street.
102. J. Smith, 2, Green Street.

Along with the names are entered details relating to the service for reference. A set of ivorine labels is stocked in the office numbered to correspond with the above figures, and one of these labels is fixed over each meter on consumers' premises. This provides a check both on the proper entries of the meters and on the readers. For instance, in the above example, J. Smith requires two meters, and he is therefore entered twice. The meter fixer therefore takes out labels 100 and 102 and screws them to the meter board over the meters. Now, suppose that the clerk gives out label 102 to the fixer, but forgets to enter J. Smith a second time on line 102. The next application, say, Robinson, is entered at 102. The meter fixer comes along later and asks for label 102 to fix to Robinson's board. This label is missing, and eventually it is found that it went out to Smith. This ensures that Smith's second meter is entered, even if forgotten at first. The same thing would apply, even if Smith had a dozen meters.

The numbers serve also as a means of checking the electricity accounts. To enable this to be done, figures are written out on a sheet of foolscap, up to the highest in the book. The numbers are read off from the actual accounts, and the corresponding figures on the sheet are struck off. Any unread or vacant services remain untouched, which brings to light all services whose meters have not been seen during the quarterly reading.

In the example here given, the numbers 5 and 13 are uncrossed, proving that accounts have not been made out for these meters.

1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17 18 19 20

All unused services thus come to light every quarter, thus keeping the melancholy list of vacant services always in sight. This method of checking accounts is particularly useful where a card ledger is employed, as it ensures that no card has been mislaid, a malady incidental to cards. The list should be examined and signed by a responsible official to ensure that no services are lost sight of, while at intervals all unused connections should be examined to see that they are in order and not supplying current.

Card Index.—A card index may be kept showing consumers grouped according to their streets. The cards may be written up with details of prices to be charged, notes of special agreements, &c., and the consumers' ledger and meter readers' books may be written up from them. Cards of different colours may be used to indicate special circumstances, such as guaranteed minimum payments and the like. Some stations keep their consumers' accounts entirely on cards, which saves writing up the ledger once a year. While this is a gain, the card ledger is not without objections. Cards are often cramped for space, providing much less room than a book, while they may become dirty after prolonged use. The difficulty in adding up the quarterly accounts is another hindrance to their success; the figures may be transferred to sheets of foolscap for this purpose, but that largely gets rid of the saving of time; they may be added up with the aid of an adding machine, but these are still costly and not without need of upkeep. Probably their use is not justified in smaller stations.

Consumers' Ledger.—The ledger may be arranged to take two quarters at an opening, and if alternate sheets are cut back, one list of names will serve for a year, after which it must be rewritten. Every fifth line may be ruled strongly to make it easy to follow an account right across the book.

Meter Books.—Loose leaves clipped into a cheap folder make an efficient meter book. These are written up every year. They might be made to last longer, were it not that they inevitably become dirty after their four quarters' use, indeed, the reader cannot be expected to keep his books clean after visiting coal cellars and other such places that have such an attraction in the eyes of those responsible for the location of these useful instruments. Much trouble was experienced at one station owing to the men leaving large numbers of meters unread, and giving excuses appropriate to the occasion for their neglect. At last there was almost a competition amongst them to see who could bring in the biggest list of unread meters. A rule was then made that each man should carry a notebook in which he was to enter the names of all consumers whose meters had not been seen, and he has to attend to these himself without delay. The regulation has worked well, and there are now not many

cases where the men do not manage to get their readings on the first round.

Meter Faults.—It is usual, in books provided for the purpose, to leave a space at each name for entering up faults noted during the readings. This is not a good plan. There is too little room for proper entries, especially in winter when the man's hands are cold, while the arrangement fails altogether when reports have to be made two or three quarters running. Even when made, the reports are not accessible, requiring labour to pick them out. Where meter books are used, as described above, the sheets may be printed on one side only, and all notes may be written together at the beginning of the book, where the head of the meter department can get at them with the least possible trouble. The list may be signed each quarter by a responsible person *after the faults have been rectified.* This arrangement preserves the whole list of faults intact until all are seen to, which greatly helps to ensure that faults shall not remain without attention. It is desirable that meter readers should take different rounds on successive quarters, in order to provide a check on each other.

Other Books.—The other office books call for little notice. Time has been saved by the use of duplicate books for consumers' sundry accounts. These are very convenient, as the duplicate remains for reference after the account has been torn out and sent to the consumer. Duplicate advice books are useful where many lamps and sundry articles are sold from the station. The advice note should be signed in duplicate by the receiver of the goods. This provides a good check for both parties.

SMOKE PREVENTION.

[COMMUNICATED.]

That there is a strong prejudice against attempting to prevent smoke in the combustion of bituminous coal is undoubted. Whence does this prejudice arise? Very probably from the fact that smoke prevention has been for years the happy hunting-ground of the patentee of what, in their incomplete state, rarely amount to more than useless fads. Most smoke prevention devices contain some good principle in them, but the combustion of coal requires a number of factors of a chemical, physical, and mechanical order, if satisfactory results are to be obtained. Many devices provide for the introduction of air above the fires, either at the bridge or at the doors. Most of them are characterised by no little ingenuity, and are correct so far as they go, but some of them do not provide for the mixture of that air with the gases to be burned, and failure results. Others again, and this refers to nearly all appliances, fail to provide the requisite temperature necessary for the full combustion of hydro-carbon gas. Only comparatively recently has this temperature requisite been recognised at all widely. It was recognised by one man many years ago, who built a lot of firebrick into the bottom of the flues of the Lancashire boiler beyond the bridge, this, by the way, being levelled down. A well-known expert at the time could say nothing better for this than that the patentee charged £20 for half a cartload of firebrick. Yet the principle was right, and has been recognised in the application of the over arch. This arch is often too short. Given a sufficient length of over arch, there would be certainty of perfect results, for there would be a sufficient temperature, and ultimately perfect mixture of the gases. But the conveniences of practice put a limit on long arches, and the ordinary long arch does not always provide the perfect mixture that is necessary. A little thought on furnace conditions will show why this is so. Coal is admitted at the front of the furnace and gives off the worst and coldest fuliginous gases at that point. These gases form, therefore, the upper stratum of flowing gas in the furnace; they lie next the over arch and mix, to some extent, with the incoming air, and at least commence to burn. Arrived at the end of the arch, they turn sharply upwards and pass directly between the cold tubes of the boiler—a water-tube boiler is here assumed, because it is one of the best to which to apply smoke-preventing brickwork. But these cold tubes quench all combustion, and soot is deposited from the quenched hydro-carbons, as it always is when hot hydro-carbon gases are quenched. How is this to be remedied without excessive length of furnace? The best plan appears to be to employ a second arch overlapping the first one and springing from the top of the bridge. Thus, in place of the furnace in fig. 1, we get that in fig. 2. The gases which have hitherto been travelling on the upper

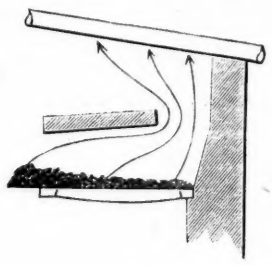


Fig. 1.

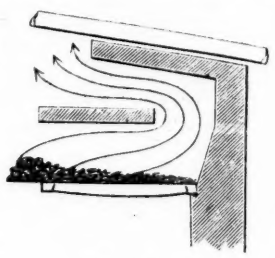


Fig. 2.

stratum of the furnace mixture are now turned over against the top of the first arch, and better mixed with the lower stratum which comes under the second arch hot from the bridge. The rough diagrammatic sections of the two styles of furnace will probably make this clear.

It is, of course, open to any designer to make the single arch of a water-tube boiler to extend nearly the full length of the tubes and thence, from the back end, allow the gases to travel to the front under and amongst the lower half of them under compulsion of a longitudinal tile baffle. But it is not altogether desirable to build such long over-arches, and the two shorter and stiffer arches, with their turnover and mixing effect, are more commercially practicable.

They have the advantage, too, that they do not require any additional floor space. They merely demand the raising of the boiler so as to provide for the extra brickwork and combustion chamber space. Nor is the cost prohibitive, especially if the work be done *ab initio.*

Many engineers, however, start out with no constructional margin beyond the cheapest and commonest setting, so that, when faced with the smoke difficulty, they find themselves barred from a correct solution, except at great expense in moving boilers and changing steam pipes.

Intrinsic Brightness.—Messrs. H. E. Ives and M. Luckiesh recently published in the *Electrical World* an account of measurements of the intrinsic brightness of illuminants by a new method. The intrinsic brightness of an image in space, viewed from the side away from the lens producing it, is equal to the brightness of the source, if the beam of light fills the pupil of the eye or the aperture of the telescope used to view it. Hence the image of a Nernst glower, under these conditions, forms a uniform background which can be focused in the same plane as that of a lamp filament in a bulb, overcoming difficulties due to distortion by the glass of the bulb, &c., and by varying the brightness of such a background, it is easy to match the brightness of a filament very accurately. The methods of calibrating the brightness of the image, obtaining suitable strips in the case of flame sources, &c., are described in the article, and the authors give the following results:

Source.	Candle-power per square mm.
Crater, carbon arc	130
Magnetite arc	6·2
Nernst glower (115-volt, 6-ampere D.C.)	4·7
Incandescent lamps:—	
Tungsten, 1·25 W.P.C.	1·64
Graphitised carbon filament, 2·5 W.P.C.	1·2
Tantalum, 2·0 W.P.C.	0·9
Carbon, 3·1 W.P.C.	0·75
Carbon, 3·5 W.P.C.	0·63
Carbon, 4·0 W.P.C.	0·50
Acetylene flame (1-ft. burner)	0·082
Acetylene flame (¼-ft. burner)	0·057
Welsbach mantle	0·048
Welsbach (mesh)	0·067
Cooper-Hewitt mercury-vapour lamp	0·023
Kerosene flame	0·014
Gas flame (fishtail)	0·004
25-watt frosted tungsten lamp:—	
Tip	0·0026
Side	0·0093

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Plea for the Contractor.

Recently my attention has been called to the variety of firms who tender for an ordinary electric wiring contract. In a list of tenders for this class of work, it is the usual thing to find (besides the legitimate wiring contractor) cable manufacturers, electrical accessory firms and lamp factors. These outside firms only tender with one object in view, viz., to supply their own special commodity, therefore they base their tender on the net cost price of their particular line or lines. After this indictment it is obvious that a wiring contractor has no chance whatever of competing, as he tenders on a profit on material and labour basis. It is common knowledge that this unfair tendering and indiscriminate net cost touting by lately respectable electrical manufacturing firms is seriously injuring the wiring contractor.

In conclusion, I might say that, if the Contractors' Association do not awake and look around, their only use will be to collect funds to provide pensions for needy contractors.

Percy Collins.

Wimbledon, S.W., *April 3rd*, 1911.

Territorial Training.

As a member of His Majesty's Territorial force, I should like to see a uniform system adopted by all electrical manufacturing firms in the matter of granting facilities to members of their staffs for attending their annual training.

I am fully aware that a number of the leading firms give to members of their staff who are Territorials, three weeks' holiday with full pay—*i.e.*, time for training and one week's holiday, while others give no extra holiday at all.

It seems hard lines on some patriotic men that, because of their patriotism, they should lose their annual holiday, for though camp is certainly a change for most of us, still, it is work.

Cannot you, through the leading journal of the electrical industry, do something in this matter?

Territorial.

[We would gladly comply with our correspondent's suggestion, but there are serious difficulties in the way. The organisation of a uniform system of granting facilities for training appears to be quite impracticable, as the conditions are different in every case. We can only commend the foregoing letter to the notice of employers and others in authority, in the hope that they may be able to facilitate the training of Territorials in their service.—EDS. E.R.]

Annual Dinner.—The fifth annual dinner of the British Westinghouse Engineers' Club was held on Friday evening last in the banqueting hall of the Midland Hotel, Manchester, when a company of over 170 members of the staff assembled. After dinner a very enjoyable programme was proceeded with under the chairmanship of Mr. J. S. Peck. Mr. W. W. Blunt, the general sales manager, proposed the toast of "The Company," and mentioned that the company's sales for this year were much in excess of those in the corresponding period of last year. Mr. C. A. Park, the recently appointed managing director, responded on behalf of the company, and expressed his pleasure at joining the staff on this occasion and the pride he felt at being connected with so large and important an undertaking as the British Westinghouse Co. Mr. D. N. Dunlop, speaking on behalf of his colleagues of the sales organisation department, expressed appreciation of the appointment of their general sales manager, Mr. W. W. Blunt, as a director of the company, which was suitably acknowledged in a short speech by Mr. Blunt. The toast of "The Works Organisation" was proposed by Mr. C. H. Baldwin, who spoke in appreciative terms of the efficient manner in which the works handled their end of the business. Mr. P. A. Lange, managing director of the works, in responding, mentioned that while the works had an extremely heavy load to carry in consequence of the large increase in orders, he was fully confident that they would be able to meet all demands made upon them. The toast of "The Engineers' Club and the Foremen's Association" was proposed in a humorous speech by Mr. A. McKinstry, responses being made by Mr. J. S. Peck, for the engineers, and Mr. R. W. Rowe, for the foremen.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The Bennis CO_2 Recorder.

MESSRS. ED. BENNIS & CO., LTD., of 28, Victoria Street, S.W., have recently introduced what they claim to be the simplest CO_2 recorder on the market.

The apparatus, which is shown in fig. 1, is provided with a positive belt drive, and is fitted with two mercury-sealed pumps—A, a quick-running pump, supplying B, a slow-moving pump, with a uniform pressure of gas. Pump B delivers a measured quantity of gas into the burette C, containing caustic potash. The burette holds

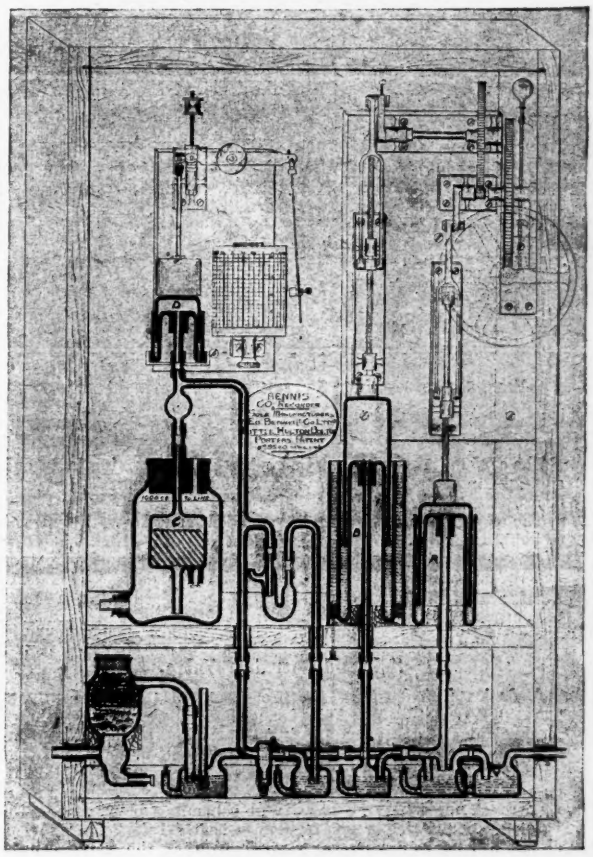


FIG. 1.—BENNIS CO_2 RECORDER.

80 per cent. of the gas delivered by B, and the remaining 20 per cent., if it contains no CO_2, passes into bell D, filling it at its maximum travel.

Assuming a certain percentage of CO_2 present in the gas, this is absorbed in the potash, and bell D travels so much less in consequence.

The bell D is connected to the recording apparatus, its movements depending entirely on the amount of CO_2 present in each discharge of pump B.

Each pump is provided with inlet and outlet valves of the mercury-sealed type, the mercury in which can be withdrawn, for filtering, through a plug in each valve.

The caustic potash is sufficient for a month's working at 12 hours per day, and the chart is marked for 24 hours.

A Small Telephone Switchboard.

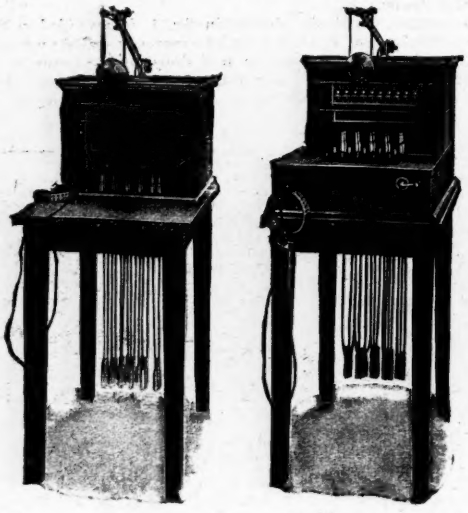
A NOVEL type of small switchboard capable of being not only easily increased in capacity, but at the same time readily convertible to suit various service conditions, has been placed on the market by the WESTERN ELECTRIC CO., LTD., London. It may, perhaps, best be described as being constructed on the "sectional bookcase" plan. The telephone company who operate a small exchange are confronted with the problem of selecting a switchboard of the proper style and capacity to meet their service conditions at the present time as well as in the future. This problem has been all the more perplexing when the telephone company are unable to determine with any degree of accuracy what their future requirements may be. Thus, they have often found it necessary either to purchase a switchboard that would serve for only a short time, and then discard it, or they have found at a later date that they have purchased a switchboard of such a large size that they will never be able to make full use of it.

This and other problems have been cleverly solved by the Western Electric Co. with their new No. 1,800 unit type switchboard shown

herewith. This switchboard is built up of several separate parts, comprising top units, line units, cord units and supporting units. As the telephone company's requirements increase, so can the switchboard capacity be increased, and at all times the telephone company have a minimum investment.

The top units can be supplied with either a hand telephone set or a suspended transmitter.

The line units can be supplied with either self-restored jacks and signals, manually restored drops and jacks, ringers, &c.



Figs. 2 and 3.—Unit Switchboards, with Combined Signals and Jacks.

The cord units can be supplied with either listening jacks and supervisory drops or ringing and listening keys and supervisory drops.

The supporting units can be supplied for the wall type of switchboard, for floor type or for desk type.

Many small switchboards are situated in business places or private homes, where the operator has other duties to perform. Under such conditions the wall type, equipped with a hand telephone set, is found the most desirable.

Solenoid-Operated Valve.

A device just developed by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., is a solenoid-operated valve, shown in its final design in the accompanying illustrations. The construction employed permits of the placing of the plunger inside the piping system, and entirely eliminates stuffing-box friction. The energising of the coil lifts the solenoid plunger through a short free travel, unseating the valve with a hammer blow. After the valve is started the pressure becomes nearly balanced. The coil circuit can be run wherever desired, so that the valve can be

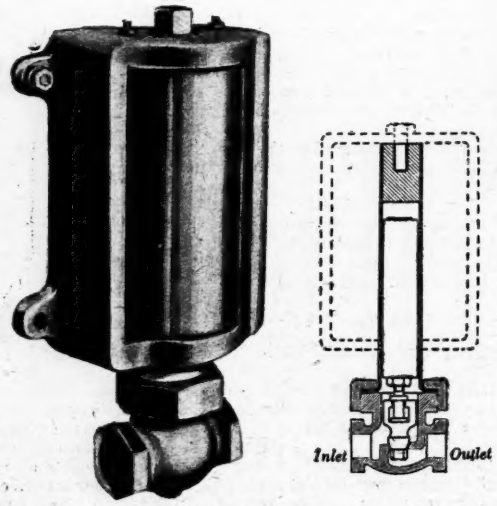


Fig. 4.—Solenoid-Operated Valve. Fig. 5.—Section of Valve.

operated from any position. These devices find many uses in hydraulic or pneumatic systems, with self-starters, for remote control of valves used for setting the brakes in a pneumatic brake-control system, &c.; when arranged with a thermostat in a heating system they can be made to control automatically the flow of steam; in signal systems where air-operated whistles are used these valves save piping and enable the ready control from a central point.—*Electrical World.*

Turbine Feed-Pump.

We have received some particulars of the "Sun" patent turbine pump for boiler-feeding purposes, as made by the Sun Patent Evaporator Co., Ltd., of 428, Tower Buildings, Water Street, Liverpool. A motor-driven pump of this type is illustrated in fig. 6; the body casing is lined throughout with a renewable cast-iron or bronze liner, machined internally and externally to gauge, and containing the guide ports. It can be withdrawn by removing the end cover only. A solid cast-bronze machined impeller is provided, mounted on a shaft running in long bearings, designed to exclude grit, &c.

The pump has been developed under working conditions, and will deal with high-temperature feed water; preferably the water is initially delivered to the pump by the firm's patented ejector, the

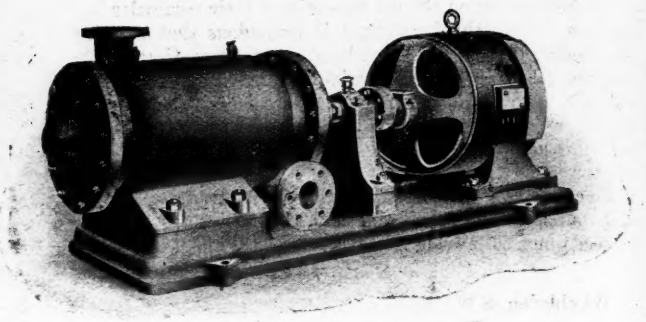


Fig. 6.—Sun Turbine Feed Pump.

use of which (by exhaust or live steam) dispenses with the first stage suction impellers.

The company point out that even with a live-steam ejector the thermal loss is insignificant; and the use of such a system, or the supply of the water under a small head, prevents the possibility of air leakage inwards, and consequent trouble with condenser plants.

Ironclad Switchgear.

The accompanying illustrations show the front and back of one of two main switchboards for a factory installation, which is being carried out by Messrs. Berry, Skinner & Co., of 78, Upper Thames Street, E.C., to the specification of Mr. Frank Broadbent, M.I.E.E. On the left-hand side of the board is provided a main interlocked change-over switch for switching the system on to one or the other of two independent supplies; this change-over switch connects the

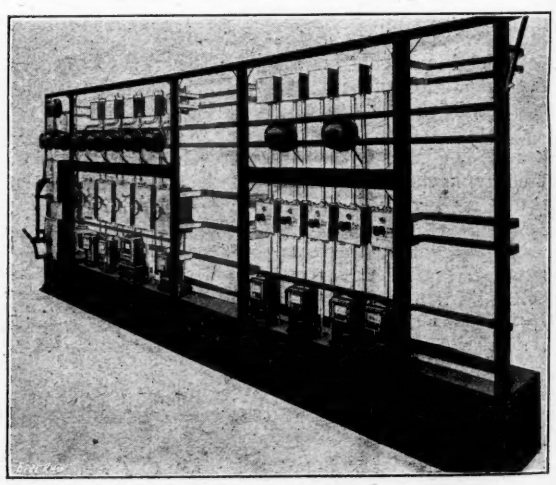


Fig. 7.—Front View, Ironclad Factory Switchboard.

supply to the bus-bars in their chamber, shown along the bottom of the switchboard. The bars feed through electricity meters to the main circuit switch-fuses, which are connected through ammeters to connection boxes at the top of the board, from which circuit cables run direct to distribution boxes. The panel next to the change-over panel is the power panel, and the one shown on the right-hand side is the lighting panel. The blank spaces shown are left to facilitate extensions to the installation at a future time. The whole board is absolutely ironclad, and is specially designed to meet the latest requirements of the Home Office for medium pressure circuits. The board is wired complete before dispatch, so that no cable connections are required behind the board, the wiring contractors' work commencing at the connection boxes at the top.

By this arrangement, at least 6 ft. width is saved in the switchboard room, as there is no need to leave any space at the back, and the boards are fixed opposite to each other in the room. With an open board of the ordinary type, not only would 3 ft. be required behind

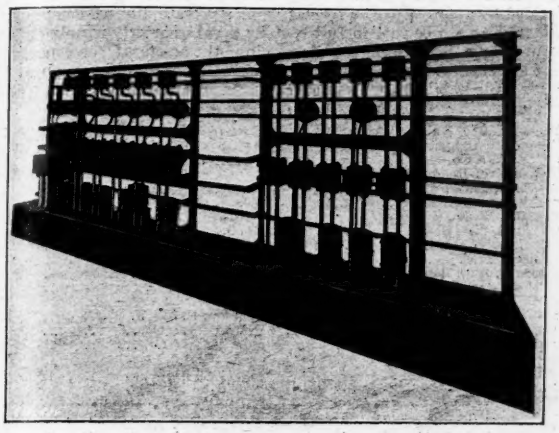


Fig. 8.—Back View of Ironclad Switchboard.

each board, but about 6 ft. also between the two. With the type of switchboard in question in crowded manufacturing areas, the value of the ground space saved is more than sufficient to pay for the outright purchase of the switchboard.

Mine-Shaft Signalling Apparatus.

Messrs. Siemens Bros. & Co., Ltd., of Caxton House, S.W., have brought out a mine-shaft signalling apparatus in which the orders given are visually indicated, in addition to the usual bell signals. Indicators, such as that shown in fig. 9, are placed at the pit bank and at each level, and the one shown in fig. 10 at the engine room. The signals from the levels are given by turning the upper switch to point to the order to be transmitted, and giving the customary rings on the bells at bank and in the engine room by means of the bell-push. If the banksman agrees with the order, he replies with the bell, and turns his switch also to the same signal, when the latter is simultaneously illuminated at the three stations. The order thus indicated remains in force until some other operation is to be carried out.

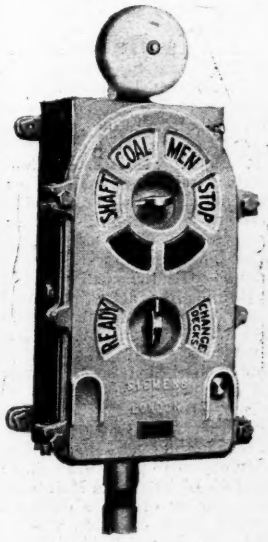


Fig. 9.—Pit-Bank Indicator.

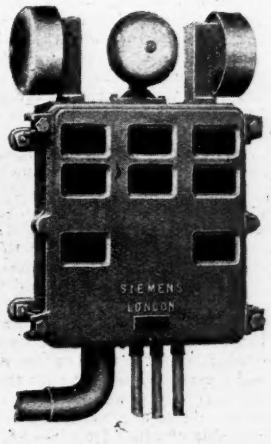


Fig. 10.—Engine-Room Instrument.

Mine-Signalling Apparatus (Rutherford's Patent).

While the upper switch defines the nature of the operation, the lower one is used to control its execution; thus when the onsetter at a level is ready for winding, he turns the switch to that signal and rings the bell; when the banksman does likewise, the signal is illuminated at all three stations, and the winding commences, the lamps being extinguished directly the engine starts. The operation of changing decks is controlled in the same way.

The bell circuits are separate from the luminous signal circuits, and can therefore be operated quite independently of the latter, while when used together they confirm one another; moreover, the engineman cannot receive the luminous signal until both the onsetter and the banksman are ready. It is impossible for more than one order at a time to be transmitted, or for an order to appear without the concurrence of both sending stations. The only exception to this is the "stop" order, which can be given from any station and at once appears on all the instruments, while a trembler bell is simultaneously rung in the engine room. The apparatus is enclosed in substantial watertight cast-iron cases, and the connections are made with armoured cable.

"Neotherm" Batteries.

We have already referred to the "Neotherm" copper-oxide cell, in which the depolariser is attached to the iron containing vessel, and can be regenerated by simply heating the latter in an oven; Messrs. Siemens Bros. & Co., Ltd., are now making this up in the form of batteries, such as that shown in fig. 11, giving 150 ampere-hours (at 1 ampere) at about 6 volts. These batteries form

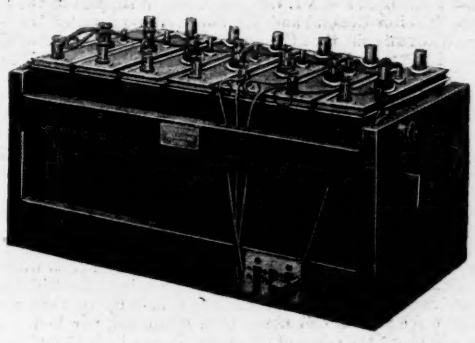


Fig. 11.—"Neotherm" Battery.

a convenient substitute for accumulators, as they do not run down when idle, give a regular discharge up to the point of exhaustion, and are much more substantially constructed. Large currents can be drawn from them without injury, and they contain no acid. For driving small fans, lighting glow lamps, ignition of internal-combustion engines, &c., they should prove very convenient.

LEGAL.

Electricity in Scottish Mines.—The Charges against Managers.

Sheriff Hay Shennan, at Hamilton, on Thursday last week, issued his decision in the cases heard in the previous week. The judgment was awaited with great interest. The respondents were Robert McKay, the resident manager at Cornsilloch Colliery, and James Salmond, Hamilton, general manager to Messrs. Archibald Russell, Ltd. The charges arose out of complaints by H.M. Inspectors with regard to the electrical apparatus in Millburn Pit, which forms a portion of Cornsilloch Colliery. The charge against Mr. McKay was that he had, on October 20th last, in the Drumgray coal seam, (1) failed to efficiently cover the electrical haulage motor; (2) failed to have the frame of the motor efficiently earthed; (3) failed to have the terminal and starting switch properly covered; (4) failed to efficiently or suitably protect an electric lighting wire and joint; and (5) in the Virtuewell seam suspended electrical cables on iron nails instead of by leather or other flexible material.

His Lordship convicted McKay on the charges which dealt with the insufficient covering of a commutator and switch of a haulage motor, the inefficient earthing of the motor frame, and the suspending of cables from nails instead of by leather or other flexible material; he dismissed the remaining charges. Commenting on the case, the Sheriff remarked that he was bound to say that, in the circumstances of this case, the offences did not seem to him to be very heinous. Those in charge of a mine, not unnaturally, though wrongly, interpreted Rule 55 as meaning that the special rules did not apply to them at all, and they apparently went on from day to day empirically, and apparently without any trouble arising. He did not wish to encourage laxness in the use of electrical installations, and after this case the same excuses would not exist. He thought it fair to let the respondent go with an admonition.

The charge against James Salmond, the general manager, was to the effect that on the date in question he had failed to have a competent person on duty in the pit where electrical apparatus and machinery were in use. The prosecution, in this case, alleged incompetency on the part of John Young, the person in charge of the electrical apparatus. For the defence it was argued that the prosecution here was against the wrong official, as, according to Rule 2, the appointment of competent persons rested with the colliery manager and not the general manager.

In this case the Sheriff found the respondent not guilty. His Lordship stated that he did not deal with the question whether accused was responsible for the appointment of the competent persons, because, in his opinion, the evidence was that the respondent

was entitled to regard the engineer, John Young, as a competent person. The word "competent" was difficult of construction, but the evidence on Young's qualifications was such that he could not hold the respondent criminally negligent in regarding Young as competent for the work entrusted to him. Young got a high character for practical ability from Mr. Anderson, managing director to Anderson & Boyes, and Young's own appearance suggested a shrewd, capable and adaptable man.

Sir Oliver Lodge's Wireless Telegraph Patent.

Mr. Justice Parker, in the Chancery Division on Tuesday, April 4th, commenced the hearing of a petition for the prolongation of Sir Oliver Lodge's patent for wireless telegraphy.

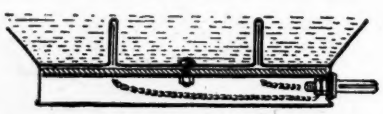
Mr. Walter, K.C., and Mr. Gray appeared in support of the patent, and the Solicitor-General and Mr. Sargeant represented the Crown.

Mr. Walter said that the petition was presented under Sec. 18 of the Patent and Designs Act of 1907, and it asked for the extension of letters patent No. 11,575 of 1897, granted to Prof. Oliver J. Lodge. The subject was one his Lordship had already heard something about, and it would be necessary to go somewhat into the history before going into the specification. He had no opponent but the Crown, who had presented certain grounds of objection, which seemed to him not to be applicable to the case. His Lordship would, no doubt, remember something about the history of the scientific discoveries which led up to wireless telegraphy, and it would be necessary to consider them, owing to the particulars of objection that had been put in by the Crown. They began in the year 1847, and Lord Kelvin in 1853 worked out mathematically the discharge of a Leyden jar. That determined the oscillatory nature of the discharge, and up to that time the idea of wave tension had never been suggested, nor had anything been said about the effect of the ether. It was in 1865 that it was for the first time shown that the speed of the ether wave was the same as the speed of light. In 1880 G. F. Fitzgerald proved that he could excite ether waves, but did not say how it could be done. In 1883, however, acting on the Kelvin experiments of 1853, he suggested that the working of the Leyden jar ought to produce waves, and in that year, in a lecture to the British Association at Southport, he suggested that the desired result might be obtained by utilising the oscillatory discharge of the Leyden jar if only the waves could be detected when generated. Sir Oliver Lodge was working on somewhat different lines. He about that time heard of Hertz, but Hertz's method was not one on which any system of wireless telegraphy could be founded. Sir Oliver Lodge continued his investigations, and arrived at what he called syntonic Leyden jar experiments. That brought them to the lectures of 1894, with which the Court was familiar. When at Oxford, Sir Oliver Lodge sent messages from one building to another by wireless. Nothing further was done until they came to the Marconi patent of 1896, which was not published at the date when Sir Oliver applied for his 1897 patent. The application was made in May, 1897, and although Marconi's application was made in March of 1896, the specification was not published until July of 1897. Marconi's 1896 patent had nothing whatever to do with the Lodge patent of 1897.

(To be continued.)

BUSINESS NOTES.

Efficiency of Electric Heating.—Referring to Prof. Fleming's Cantor lecture at the Royal Society of Arts last week, in which he gave a number of figures as to the efficiency of various methods of electric heating, showing that the immersion form of heater was the most efficient, Messrs. Simplex Conduits, Ltd., write us expressing surprise that the efficiency given in the case of the only one belonging to this class quoted was not so high as might be reasonably expected. This was the Therol heater, which, with a consumption of 300 watts used for 24 hours, enabled 38·4 gallons



Section of Simplex Heater.

of water to be raised from 50° F. to 110°, giving an efficiency of 92 per cent. The immersion form of heater is adopted in a modified form for a large proportion of Simplex apparatus, the method of applying the heating element to the utensil being shown in the accompanying sketch, and the efficiency obtained seems to be greater than that found by Prof. Fleming. In a 3-pint copper kettle (actual capacity, 3 pints), for example, they say, the quantity of water is raised from 60° F. to boiling point in 14 minutes, with a consumption of 750 watts, giving an efficiency of 97·2 per cent. The construction of the kettle is by no means special, the particular type being of ornamental design in copper for general domestic use.

The lower efficiency mentioned by Prof. Fleming was no doubt due to the long period during which the heating took place, as explained elsewhere in this issue.

Private Meetings.—F. Shalders and T. Davis, trading as Shalders & Davis, electrical engineers and contractors, Southampton.—In our issue of March 24th particulars were given of the meeting of the principal creditors of the above, when it was decided to approve of the formation of a private limited company, the creditors to be paid in full by four equal quarterly instalments, secured by a debenture over the whole of the assets of the concern. The statement of affairs submitted showed a substantial surplus of assets over liabilities. The following firms are interested, as well as many others for smaller sums:—

Anglo-Asbestos Rubber Works	£16	Harris, Thos., & Co.	£15
British Steam Specialties	32	Holder, J., & Son	54
Braby, F., & Co.	35	Johnson & Phillips	29
British Ever-Ready Works	22	Jones & Campbell	16
Bradford, Thos., & Co.	16	James & Rosewall	18
Barringer & Co.	86	Kitchen & Co.	14
Brading, W. H., & Son	22	Liverpool Electric Co.	26
Cartland, J., & Son	13	Moeller & Condrup	80
Callender's Cable Co.	32	McDowall Stevens & Co.	53
Crossley Bros.	57	Nettleford & Sons	24
Clark, F. A., & Son	22	National Radiator Co.	222
Cutting Bros.	14	Notent, W. P.	12
D. P. Battery Co.	34	Peyton & Peyton	15
Dilworth & Carr	12	Pearson, E. J. & J.	12
Daniels, T. H. and J.	23	Rowe Bros. & Co.	14
Edison & Swan	375	Russell, J., & Co.	220
Evered & Co.	16	Siemens Bros.	53
Electric Ordnance Accessories	27	Smith, R. & J.	13
Fordham, W. B., & Sons	32	Smart, A., & Sons	15
Glover, W. T., & Co.	40	Saxonia E'ectrical Wire Co.	16
General Electric Co.	41	Sessions & Sons	17
Hands, A. C.	780	Turner, T., & Co.	16
Hinks, J., & Son	32	Union Cable Co.	55
Hunt, R., & Co.	18	Vaughan, H. & T.	51
Hudson, J., & Co.	65	Wilson Hartnell & Co.	43
Hart Accumulator Co.	32		

Worthington Contracts.—Amongst recent orders received by the Worthington Pump Co., Ltd., of London and Newark-on-Trent, are the following:—

Three Worthington surface condensing outfits, each for 35,000 lb. of steam per hour with complete Worthington patent rotary combination of air and circulating pumps driven by Worthington steam turbines, together with two Worthington turbine-driven centrifugal feed pumps and feed heating apparatus, for Newcastle Electric Supply Co., two sets being required for their Bowden Close power station, and one set for Grangetown power station (through Messrs. Merz & McLellan, consulting engineers).

One surface condensing set with Worthington patent rotary combination of air and circulating pumps steam-turbine driven, for the B.T.-H. Co., of Rugby; and a smaller set, for Brisbane tramway system.

Nine jet condensing plants and nine surface condensers, four of the latter being arranged with Worthington horizontal Simplex combined air and circulating pumps, for service at home and abroad.

Three Worthington patent steel cooling towers for natural and forced draught (through the firm's Continental branches).

Five Worthington patent vertical centrifugal pumps driven by gas engines for sewage works in India. This pumping installation is stated to be the first of its kind in India where the power is derived from suction gas.

Six motor-driven centrifugal pumps for the Continent for ozone service.

Four centrifugal pumping sets with condensers, air and circulating pumps, boilers, superheaters, feed pumps, travellers, &c., for the Imperial Dock, Constantinople.

Bankruptcy Proceedings. — Ludwig Lehmann, merchant for electrical and other goods, 68, Basinghall Street, and 26, Milton Street, E.C.—The public examination was resumed last week before Mr. Registrar Brougham, at the London Bankruptcy Court. The debtor failed in January with total liabilities £16,108 (unsecured £12,180), and assets valued at £7,711, the chief items being (1) interest in Russian coalmine, £4,000; (2) three book debts, £1,708; and (3) bills of exchange, &c., £1,369. Mr. Tindale Davis, on behalf of Mr. E. H. Hawkins, the trustee, elicited the fact that the bankruptcy petition was presented on March 10th, 1909, but the receiving order was not made until January 19th, 1911, the debtor having obtained several adjournments, and having throughout disputed the claim of the petitioning creditor. The whole of the present liabilities had been incurred since the petition was presented; witness did not tell the creditors of the petition, and he contended he was justified in so acting, because he did not owe the debt, and had not received one penny in respect of it.—Mr. Davis: Did you purchase from Siemens Bros. a large quantity of electric lamps to the value of £170? Yes.—Did you dispose of those goods to the United Lighting and Maintenance Co.? I cannot tell you.—Did you sell them at 50 per cent. discount off cost price? Certainly not.—Did you sell them at a profit? Yes, sometimes 5 per cent., and sometimes 10 per cent. profit.—The debtor further stated that in some cases he purchased goods in order to fulfil orders, and in others to put into stock. He had a verbal agreement with the United Lighting and Maintenance Co. to supply them with a certain number of lamps during the year. Witness remembered selling 5 miles of cable, which he probably obtained from the St. Helens Cable and Rubber Co., Ltd., but he emphatically denied having sold at £8 odd per mile, a line of cable purchased on credit at £10 odd per mile.—Re-examined by Mr. Albert Osborn (Osborn & Osborn), the debtor said he had been in business for 20 years before this failure, and had not previously been in financial difficulties. He disputed the claim of the petitioning creditor, because it was based upon a bill which he endorsed, without consideration, many years ago. He defended proceedings in the Mayor's Court, and obtained adjournments of the hearing of the bankruptcy petition, because he would not acknowledge any liability. Between the presentation of the petition in March, 1909, and the making of the receiving order in January, 1911, he paid away £9,692 to creditors, and could at any time have paid the small amount claimed by the petitioner.—The examination was concluded.

Edward Surtees, electrician, King Street, South Shields.—April 21st is the last day for receipt of proofs for intended dividend. Mr. T. Gourlay, Official Receiver, 30, Mosley Street, Newcastle-on-Tyne.

J. A. Bauer, electrical engineer (Electrical and General Engineering Co), 17, Gracechurch Street, E.C.—First and final dividend of 8¾d. in the £, payable April 20th. (Corfield & Cripwell, 119, Finsbury Pavement, E.C.)

France.—La Société Generale d'Eléctricité Paris-Province is the name of a new company that has recently been formed in Paris (1, Rue Hauteville), with a capital of £10,000.

Bennis Stokers.—Messrs. E. Bennis & Co., Ltd., have received the following contracts:—

Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, Generating Station, Stalybridge.—Four "Bennis" stokers and self-cleaning compressed air furnace for 8 ft. 6 in. Lancashire boilers.

Heywood Corporation Electricity Works.—Two "Bennis" stokers and self-cleaning compressed-air furnaces.

Book Notices.—*Simmance and Abady's Copyright Tables of Corrections for Harcourt's 10-Candle Pentane Lamp.* London: Alexander Wright & Co., Ltd.—The standard unit of light in this country being derived from a combustion apparatus, the humidity and pressure of the atmosphere exert a marked influence upon the results of tests, and as the calculations necessary to determine the proper corrections to be applied are arduous, they are frequently neglected, with highly detrimental consequences to the accuracy of measurement. Recognising this, Mr. Abady has gone to the trouble of making all the necessary calculations, on the basis of the formulæ determined by Mr. C. C. Paterson at the National Physical Laboratory, and embodying them in a set of nine tables of corrections for the pentane lamp, mounted on stout cards, and bound together in very substantial covers, for hanging on the wall. The tables are calculated for the widest range of conditions ever likely to be met with in practice, and include the dry-bulb readings and wet and dry bulb differences in Fah. and Cent.-degrees, with the corrected values of the pentane lamp, for nine barometric pressures, there being in all over 4,000 values. The method of arriving at the corrected results is also explained. The tables will undoubtedly be of great utility and convenience, though the necessity for them, due to the rudimentary condition of the art of photometry, is greatly to be deplored.

The Engineer's Year-Book of Formulæ, Rules, Tables, Data and Memoranda for 1911. By H. R. Kempe, M.Inst.C.E., M.I.E.E. London: Crosby Lockwood & Son. Price 10s. 6d.—This familiar annual is now in its eighteenth year, and still growing; last year it just cleared 1,200 pages, including the index—now it is well over 1,300 without the index, which alone fills over 40 pages. But mere bulk counts for little, and were it not that the contents are carefully selected and periodically revised by well-known specialist contributors, we should not lay stress upon it. In the present issue the electrical section has been entirely rewritten by Prof. C. A. Carus-Wilson, and is certainly much improved. Mr. W. H. Booth has revised the section on steam, gas and oil engines, and other subjects have been similarly dealt with; recent work of the Engineering Standards Committee has been embodied in the new volume, and other up-to-date information has been added. The book might be called the engineer's pocket encyclopædia, for there is hardly a subject connected with engineering which is not touched upon in its comprehensive pages, and if there are still any engineers who are not acquainted with it—why, so much the worse for them!

Railway Rebates from Private Sidings Traffic. By H. Osborne. Liverpool: H. D. and J. Hutchinson, 3, Lancelot's Hey. Price 3s. 6d. net.—This little book is intended for a guide to the owners of private sidings, to enable them to appreciate their rights and privileges correctly. Such owners are, of course, entitled to certain rebates from the railway company in respect of traffic handled in their sidings, and these allowances may assume considerable proportions if properly determined, but unless they know the ropes, the owners will often fail to take due advantage of them. For their benefit the author gives practical examples, in detail, and a number of tables are given showing existing rebate arrangements, as well as exceptional rates which are subject to rebates.

To owners of private sidings, whose staff do not happen to be experts in these complex matters, this book should prove not merely useful, but a highly profitable investment.

Two-in-One Code Condenser is the comprehensive title of a new system of coding invented by Messrs. J. Williams and J. Ribeiro, of 16, Mark Lane (price 30s.), which they state has been compiled in strict conformity with the International Telegraph Service Regulations and will effect a saving of 50 per cent. in the cost of telegraphing, and it appears to us that this claim is substantiated by the examples given. The system is free from the complicated formulæ and coding with which some are burdened. There is also provision for methods of checking which will, at any rate, show if there is any reason to doubt the accuracy of transmission, and the Morse signals are given to facilitate the detection of possible errors. There are two tables of syllables, one in red and one in black print, which are used conjointly, the first two or three letters always being taken from the red code "A" and the next three from the black code "B," and so on alternately, each group of letters representing a number or numbers, and thus the ordinal numbers of any code word contained in any code are reduced in a manner which permits two code words to be sent as one—hence the title of the book. To render the use of the code more secret, it is explained that prefixes may be used, but experience teaches that these, as a rule, do not fulfil their object after a time, as they can be fairly easily ascertained. The authors describe facilities by means of which the receiver of an incorrect telegram may ask the sender for repetition. Much friction and useless work is caused by senders or receivers not applying direct to the cable and telegraph companies for the correction of errors or repetition of doubtful words. As a matter of practice, telegraph companies will not acknowledge any claims or refunds for correcting or repeating messages unless request therefor has been made direct to them. Users of this code will therefore be well advised not to deal direct with their correspondents in the event of errors. Instructions in the code book are given in various languages, and this is a step in the right direction and one generally adopted by foreign houses. An index in numerical order with the syllables opposite, and one in alphabetical order with the numbers opposite, are also provided, so that no time, or as little time as is possible, is lost in coding or decoding messages. The telegraph companies will view the artificial code words resulting from the system with mixed feelings, and it cannot be admitted that their responsibility is lightened by having to transmit such combinations—pronounceable or not—as Agcufwovam, Zyvuxodvux, Pebepabbab, Awbepnamep, &c., which, when written by hand, do not appear so formidable as when in type. We have on several occasions in our columns referred to Mr. Nicholson's excellent code, which has been compiled with the view of securing accuracy of transmission, and in which an error, if made, is easily traceable, but it would appear that a code is wanting which, while effecting a substantial saving in charges, also provides words easy of transmission, and we have always asked code makers to make this their guiding principle. In a leaflet accompanying the book examples are given of the amount of money saved by the use of the code, and when it is found that a message of 12 words to British Guiana costs £4 4s. (7s. a word), while a similar message to New Zealand costs only £1 16s. (3s. a word), the utility of codes such as the one under review is patent.

"Science Abstracts." March 25th, 1911. Vol. 14, part 3. Sections A and B. London: E. & F. N. Spon. Price 1s. 6d. each.

"Electric Crane Construction." By Claude W. Hill. 1911. London: Charles Griffin & Co. Price 25s. net.

"The Physical Review." Vol. XXXII, No. 3; March, 1911. Lancaster, Pa.: "The Physical Review." Price $0·65.

"*Proceedings* of the American Society of Civil Engineers," Vol. XXXVII, No. 3, March 1911. New York: The Society.

Dissolutions and Liquidations.—F. A. Glover & Co., Ltd.—At a meeting held at Clerkenwell on March 25th, it was resolved to wind up voluntarily, with Mr. W. Peet, 27, Queen Victoria Street, E.C., and Mr. G. E. Corfield, Balfour House, E.C., as liquidators, the company not being able, by reason of its liabilities, to continue business. A meeting of creditors is called for April 13th.

British Radio-Telegraph and Telephone Co., Ltd.—This company, meeting at 5, London Wall Buildings, on March 27th, resolved to wind up voluntarily, with Mr. G. P. Grenfell, of that address as liquidator, as it cannot, by reason of its liabilities continue business. A meeting of creditors is to held on April 13th.

Rosario Electric Co., Ltd.—This company is winding up voluntarily, with Mr. H. E. Benthall, 52, Moorgate Street, E.C., as liquidator. A meeting of creditors is called for April 13th.

Electrocars, Ltd.—This company is winding up voluntarily, with Mr. J. E. Denney, 3, Great St. Helens, E.C., as liquidator. A meeting of creditors is to be held at 3, Great St. Helens, E.C., on April 7th.

Gratze Patents and Engineering Syndicate, Ltd.—A meeting is to be held at 9 and 10, Pancras Lane, E.C., on May 5th, to hear an account of the winding up from the liquidator, Mr. Stewart Cole.

Catalogues and Lists.—The "Attracta" Electrical Co., 75, Fetter Lane, E.C.—List containing a number of illustrations showing a variety of devices, &c., suitable for electrical illuminations at Coronation time. These include wood letters, crowns, transparencies, box signs, "Simplite" festoon light strip, and general papier maché decorations. Prices are given.

Messrs. Burstinghaus & Co., Ltd., 38, Upper Thames Street, E.C.—A batch of illustrated price lists relating to their various manufactures including raw-hide wheel bodies, pinions, and pistons, Swedish paper material wheels and pistons, fittings, hydraulic raw-hide packing; also lathes which, together with other engineers' tools and stores, they hold in stock.

Mr. C. H. Jeffcoat, 148, Addison Gardens, W.—Leaflet relating to the "Lamlok" electric lamp-locking clip, and giving a list of users of same.

Messrs. Sykes & Sugden, Spring Place Works, Springwood Street, Huddersfield.—Two leaflets, one describing the "Elixum" double-pole switch (500 volts); the other showing the combined supply set, consisting of the foregoing switch with S.P. fuse. These are mounted either on iron frames or on boards. Both lists contain particulars of prices.

The Key Engineering Co., Ltd., Trafford Park, Manchester.—"The Key fibre conduit and troughing picture book" contains a collection of interesting half-tone pictures illustrating these conduits and troughing and their laying. An accompanying leaflet gives an imposing list of large users—electricity supply companies and municipalities at home and abroad—who have placed repeat orders. The Manchester Corporation is the largest customer on the list, having placed 28 orders for 430,650 ft. of fibre conduit, the Westminster Electric Supply Corporation coming next with 91 orders for 354,769 ft.

Messrs. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Illustrated leaflet (No. 155) showing their colliery switchgear for use underground—a D.C. drum type starter and three-phase oil switch. This leaflet is now being circulated amongst colliery officials in view of the present uncertainty among them regarding the design of apparatus for collieries which may be dangerous on account of gas.

The Electric Construction Co., Ltd., Wolverhampton.—Pamphlet B 227, entitled "Electrically-operated Reversing Rolling Mills." The contents include in addition an appropriate preface, a statement of the advantages of electric driving, a description of the function and principle of the fly-wheel motor-generator, and a beautifully-illustrated account of the electrically-driven reversing mills at the works of Messrs. Alfred Hickman, Ltd., with diagram of connections and typical current and voltage curves of cogging mill motor. We have no doubt that this pamphlet will be studied with interest by many of our readers.

Messrs. Mosers, Ltd., 178-192, Borough High Street, London, S.E.—24-page catalogue showing, briefly describing, and giving prices of, their precision tools, taps, dies, screw plates, stocks and dies, &c., in B.A., metric and the smaller Whitworth threads.

Messrs. Ruston, Proctor & Co., Ltd., 46, Queen Victoria Street, London, E.C.—Excellently-produced catalogue (Section M, No. 1,635) of 44 pages, wherein are given full particulars, accompanied by effective half-tone illustrations of the "Ruston" gas engines and suction gas producers. Tables of powers, dimensions and weights of suction gas engines and producers of from 8 B.H P. to 130 B.H.P. for electric lighting, also town gas engines for similar service from 9 to 150 B.H.P. are given. The "Ruston" self-starter is described, and a selection of illustrations showing electrical installations using the firm's gas plant is followed by a number of testimonials. A separate leaflet describes their new type patent crude oil engines for electric lighting and other purposes.

The Edison and Swan United Electric Light Co., Ltd., Queen Street, E.C.—New leaflet (E. 2,213) containing illustrations with descriptions and tabulated prices of the "Ediswan Multax" long-burning flame lamp for D.C. and A.C.

The Adams Manufacturing Co., Ltd., 106, New Bond Street, W.—A showcard in black and white illustrating the Adams "Igranic" manufactures has just been issued by the firm, and copies will be forwarded on application.

British Thomson-Houston Co., Ltd., Rugby.—Two new publications, one a beautiful picture postcard, the other a three-fold leaflet, effectively advertising the claims—we had almost said the bewitching charms—of the "Mazda" lamp and the "Mazda-Holophane" unit. Copies can be had by contractors with their own name printed thereon.

The Electric and Ordnance Accessories Co., Ltd., Birmingham.—Neat and artistically designed folding leaflet, introducing the reader to a number of the firm's electrical manufactures.

For Sale.—The Bristol Corporation Electricity Committee has for sale a quantity of plant and scrap metal. The Torquay Corporation Electricity Department has for disposal a quantity of disused plant, arc lamps, &c. See our advertisement pages in this issue.

Trade Announcements.—Messrs. Tetley & Co., of Salford, have appointed Mr. H. B. Done as their sole representative for Birmingham and the Midland Counties. Their office and showrooms are situated at 137A, Suffolk Street, Birmingham, where samples of the firm's manufactures may be inspected.

The Electric and Ordnance Accessories Co., Ltd., state that their agreement with Mr. J. Whaley, of Belfast, and Mr. T. T. Clarke, of Dublin, having expired, they have appointed the Hurst Electric Manufacturing Co., of Clokey's Buildings, King Street, Belfast, to represent them in Ireland for their electrical manufactures.

Mr. J. P. Strange, A.M.I.E.E., who for the past six years has conducted the electrical department of Messrs. Strange & Sons, Ltd., builders and contractors, of 34, London Road, Tunbridge Wells, has severed his connection with the firm, and has commenced business on his own account at 46, Opera House Colonnade, Tunbridge Wells, at which address he is opening offices and showroom, and will be pleased to receive the latest price lists, &c.

Messrs. Strange & Sons, Ltd., of London Road, Tunbridge Wells, notify that they have reorganised their electrical department, and Mr. J. Petrie, manager of their Chichester branch, has been appointed engineer. Mr. Strange no longer represents the firm.

The Adams Manufacturing Co., Ltd., announce that their agreement with their Scottish agent having terminated, they have, for the convenience of customers throughout Scotland (except Midlothian), opened an office at 50, Wellington Street, Glasgow, where their resident engineer, Mr. A. L. Birch, will supply all information regarding their manufactures, and meet demands from stock. For Midlothian the company's agents are Messrs. Mitchell Graham & Son, 46, Buccleuch Street, Edinburgh, who also carry a stock of Igranic switchgear.

Messrs. Wright & Wood, Ltd., have appointed from April 1st, Messrs. Berry, Skinner & Co., of 78, Upper Thames Street, E.C., and Mr. Bertram T. Dale, of 18, Bigg Market, Newcastle-on-Tyne, as their sole agents for London and district, and the North-East Coast, respectively, for their motors and dynamos, motor-generators, converters, and other specialities.

Messrs. R. H. Patterson & Co., engineers and valuers, have removed to the new offices recently erected at their Forth Street works, Newcastle-on-Tyne. Mr. R. H. Patterson is now sole proprietor of the business, Messrs. Patterson and J. F. A. Cookson having dissolved partnership.

The Dowsing Radiant Heat Co., Ltd., has removed from 24, Budge Row, Cannon Street, E.C., and opened showrooms and offices at 105, Great Portland Street, W., where larger and more commodious premises are available, and whence all communications should be sent.

LIGHTING and POWER NOTES.

Accrington.—In view of the demand for electric power from Broad Oak Works and a possible increased demand from Globe Works, the Electricity Committee has decided to increase the size of the extra-high-pressure main to be laid from the electricity works to a proposed sub-station at Broad Oak, from ·05 sq. in. to ·075 sq. in., at an extra cost of £1,830, and that application be made to the L.G.B. for sanction to borrow £4,830, in lieu of the £3,000 already applied for.

The Electricity Committee has recommended a seven years' agreement to give an additional 200 KW. of power supply to Messrs. Howard & Bullough, subject to the usual sliding scale regarding the price of coal delivered at the electricity works.

Bampton.—Mr. Purves, of Exeter, has approached the Council with reference to the installation of electric light in the town, and the matter is being considered by a Committee. The public lighting costs £47 10s. 4d. a year, and it is thought that better results could be obtained for this outlay if electricity was used.

Barrow.—By the casting vote of the Mayor, the T.C. on Monday declined to completely light Abbey Road, the chief boulevard, with electricity. The cost of current was estimated at £224 per annum. Councillor Neal, chairman of the Gas Committee, said that the cost of gas was £119, and he twitted the Electricity Committee with offering current at too low a rate. Alderman Smith, chairman of the Electricity Committee, urged that electric lighting was far the best, and to use gas lights properly the cost would be £210 per annum, and he was supported by Alderman Hardy, chairman of the Highways and Lighting Committee.

Bedford.—The T.C. has decided to extend the cables to the Britannia Iron Works, at a cost of £380, subject to Messrs. J. and F. Howard entering into an agreement to take a minimum supply equivalent to £300 per annum for seven years.

Biddulph (North Staffs.).—Messrs. R. Heath & Sons have informed the U.D.C. (of which Mr. Robert Heath is chairman) that they have found that it will be quite possible to provide a system of electricity supply to Biddulph. It is proposed to bring it, by a H.T. cable, from Black Bull, and from a sub-station in Wharf Road; two lines will be run, one for street lighting and the other for private lighting and power. Mr. Heath stated that the four principal streets could be lit by 90 lamps, placed 60 yards apart. At 3d. per unit these would cost £100 a year. The Council would be charged about 1½d. per unit, and if private users were charged 3½d., and a good number of consumers were obtained, it would reap such a profit that it would be able to light the streets for nothing. The estimated cost of the erection of 90 standards and lamps, with wires from the power station, would be £1,208. The proposal was favourably received, and the chairman was asked to submit the scheme to the parish when the new Council meets.

Braunton.—Steps are being taken to forthwith form a company for the purpose of carrying into effect the E.L. scheme. The prospective site for the generating station is near the railway station.

Bridlington.—The T.C. has accepted the tender of the Electricity Committee for public lighting as under:—54 arc lamps, £15 each per annum; one 200-C.P. incandescent lamp, £6 8s.; 375 50-C.P. incandescent lamps, £4 each; 63 30-C.P. incandescent lamps, £3 each; all extra all-night arc lamps, £27 10s. per annum.

Canada.—Negotiations have been proceeding for some time between the city of Toronto and the Toronto E.L. Co., in regard to the purchase of the latter concern by the city or for some form of working agreement. The city has offered to purchase, at $125 per share on $4,000,000 stock, and to assume $1,000,000 bonded debt. The offer is subject to a rearrangement of matters with the Hydroelectric Commission. The Toronto Co. offers to arbitrate on the value, as other experts have considered the share value to be as much as $200 per share.

Chesham.—The U.D.C. has, owing to the purchase clause having been inserted in the Gas Bill by the Gas Co., deemed it inadvisable to open tenders for public lighting, and has asked the E.L. Co. to continue the public lighting for two years.

Chester.—The T.C. has decided to convert 72 enclosed arc lamps in the streets to metallic-filament lamps at a cost of £270. This will be met out of revenue account.

Continental Notes.—Austria-Hungary.—Under the name of the Oesterreichische Elektricität-Lieferungs-Actiengesellschaft, a company has been formed at Vienna, with a capital of about £104,000, for the purpose, *inter alia*, of carrying out electric lighting installations and of constructing electric tramways.—*Board of Trade Journal.*

Russia.—It is reported that the A.E.G., of Berlin, is in negotiation with the municipal authorities of Tambov, with reference to the establishment of a central electric lighting station in the town.

Germany.—The Schwarzwalder Elektricitäts Gesellschaft is the name of a new company which has just been formed at Villingen, with a capital of £25,000, to establish a central electric lighting station in the town.

France.—A new company has lately been formed in Paris with a capital of £120,000, and the title La Société des Forces Motrices

de la Vienne, to put down plant to utilise the water-power of the River Vienne, at Isle Jourdain, for the generation of electrical energy for lighting and power purposes.

Penistone.—The U.D.C. has decided to accept the offer of the Yorkshire Electric Power Co. for the supply of electric power.

A Sub-Committee has been deputed to consider the question of street lighting and to make a report thereon.

Derby.—The T.C. will supply current for Coronation illuminations at 1½d. per unit.

A loan of £6,650 is to be applied for by the T.C. for the following plant: Two 500-KW. rotary converters, £2,000; two duplicate three-phase mains to the works of Rolls-Royce Co., £3,800; transformers, £400; switchgear, £450.

Dublin.—The estimates of the Electric Lighting Committee for the year just passed showed a net profit of £2,460. Against this stands a deficiency on the previous year's working of £17,604, less some £4,147, provided out of the rates. On the other hand, the net profit is now expected to amount to £7,150, instead of £2,460, so that the debit balance, £6,306, to be carried forward, is less than expected. As the profits of the coming 12 months are expected to reach over £13,000, there will be a surplus after meeting the remaining debit charge.

Eccles.—The T.C. has received the sanction of the L.G.B. for a loan of £360 for a high-tension feeder, and of £500 for motors.

A report is to be prepared as to the use of Osram lamps for street lighting.

Owing to recent extensions, the assessment of the electricity works has been increased by £85 gross and £62 rateable value.

Epsom.—At the last meeting of the U.D.C., it was stated that the B. of T. was prepared to consider an application for permission to supply electric light in the neighbouring parish of Ewell. The electrical engineer reported that the Council could supply electricity by prov. order, or in bulk, to the Epsom R.D.C. under the Order, or by licence from the B. of T. to specific premises. The cost of laying the necessary mains, &c., would be £1,300, which would carry the supply until a revenue of £400 per year was reached, after which it would be necessary to lay a feeder cable at a cost of £1,600. If, however, the Council decided to use the third method of supply the cost would be about £510 for one main. The running cost necessary to earn £400 a year would be under £100. The Lighting Committee recommended that the Ewell district be canvassed to obtain applications for current, that the R.D.C. be asked under what conditions it would give its consent, and that if sufficient income be guaranteed the Council should apply for permission to supply specific premises.

Glasgow.—The Glasgow Parish Council has decided to proceed with the erection of a colony for epileptics to the east of the city. The buildings, which will cost about £20,000, are to be lighted by electricity, generated in the laundry block by a plant erected for the purpose.

The T.C.'s Special Committee has been empowered to make arrangements for another smoke abatement exhibition this season, provided it gets sufficient support from the probable exhibitors.

The Association of Mining Electrical Engineers has asked for a civic reception during its annual conference in Glasgow on October 6th and 7th, and the matter has been remitted to the four senior magistrates to report to the T.C.

Gloucester.—A loan of £14,000 for electricity purposes has been applied for by the T.C. The sum includes provision for additional generating plant.

Haslingden.—The L.G.B. wrote to the T.C. on March 30th with regard to its application to borrow £8,750 for electric lighting, and said it would direct an inquiry to be held on the matter.

A deputation from the Corporation has met the Accrington Sub-Committee regarding a modification of terms entered into for the supply of electricity in bulk to Haslingden. It was agreed to provide for an additional main at a cost not exceeding £3,500, the Corporation consenting to increase the minimum payment by a sum equal to 4 per cent. on any capital expenditure on such mains exceeding £3,000.

Hendon.—The R.D.C. has accepted an offer from the North Metropolitan Electric Supply Co. to light standards on the Edgware Road from sunset until 1 a.m.; formal notice is therefore to be given to the Harrow and Stanmore Gas Co. to terminate their contract.

Kingston-on-Thames.—Incandescent lamps of high power are to be substituted for the present street arc lamps. A Stores Committee is to be formed in connection with the electricity undertaking. In future a statement of the financial position of the undertaking is to be submitted to the Committee quarterly.

Lancaster.—The profit on the last year's working of the electricity department is £97, against £450 anticipated. Councillor Heald (the chairman) states that the reduced profit arises from a decreased income from the sale of current both for lighting and motor purposes. The tramways had used £93 worth less current. The expenditure of the Electric Lighting Committee was £182 more than estimated. The more efficient lamps and empty shops accounted for the decreased consumption.

Leeds.—The Education Committee has appointed Mr. J. Falshaw Watson as consulting electrical engineer for the new training college at a remuneration of 5 per cent. on the cost of the work.

Leyton.—The electrical engineer reported to his Committee that within the last six months he had been compelled to obtain a greater number of motor meters than he anticipated. Up to the present he had ordered about £90 worth, at an average of £1 per meter. It is estimated that the surplus for the year ending March 31st, 1911, will amount to £2,674. One-half of this amount—viz., £1,337—is to be carried to the reserve fund for depreciation and renewals, and the balance is to be transferred to the credit of the rate account. With regard to the year ending March 31st, 1912, it is estimated that the surplus for the period will amount to £1,622.

London.—Poplar.—The Electricity Committee reports that a preliminary estimate of the approximate cost of the extensions proposed at the generating station has been submitted by the engineer, the amount being £42,455, in respect of the following works:—(1) Extending existing engine room and boiler house buildings; installing one 3,000-KW. turbo-generator, with condenser, auxiliary plant and necessary switchgear; fixing additional hot well; erecting two 39,000-lb. per hour water-tube boilers fitted with underfeed stokers, forced draught and hot air economisers; extensions to main steam ring; erection of overhead bunkers and conveyor plant; installing one boiler feed pump, travelling crane, &c.; (2) erecting pumping station on the destructor wharf, and installing two motor-driven circulating water pumps for condensing purposes; (3) laying a 24-in. circulating water pipe from the destructor wharf through the works to the canal side opposite Messrs. Spratts. The following is a summary of the engineer's estimate of the cost of carrying out the work:—Extensions to station buildings and erection of pumping station buildings, £13,810; circulating water pipes, £1,650; engine room plant, £11,775; boiler house plant, £9,940; pump room plant, £1,095; pumping station plant, £695; coal conveying plant, £3,000; switchgear, £490; total, £42,455. If the loan necessary for carrying the scheme into effect is sanctioned by the L.C.C. before its autumn recess, the whole of the plant would probably be available for preliminary running and emergency use by the winter of 1912, and it is of importance, the Committee go on to say, that this result should be achieved, as otherwise it would be absolutely necessary to take a bulk supply for 1912-13 of not less than 500 KW., which, under the agreement with Stepney, must be continued for three years, involving payment of a sum of £4,500. In reporting, in connection with the proposed 1908 extensions, on the alternative proposal of a bulk supply, the engineer estimated a net surplus of £3,025, and an income £43,879 when the demand should have reached 3,600 KW. The actual result of last winter's load shows a demand for 3,680 KW., with profits for the year (1910-11) of not less than £3,500, and an income (last quarter estimated) £43,936, excluding bulk supply to Stepney. The result shows an increased profit of £3,411 on the year by the adoption of the policy of installation of plant instead of obtaining a bulk supply. By similar methods of calculation, the net profit on the undertaking in three years' time is estimated at £6,373 for the year, if the extensions are carried into effect as proposed, or if extension be delayed and a bulk supply taken it is estimated the profits will not exceed £2,873 for the same year, a difference of £3,500. After completion of the extensions now contemplated, space will still remain available for a further 3,000-KW. generating set and two 39,000-lb. per hour boilers, in the proposed building extension. At present the capital employed per KW. of plant installed is £60. The contemplated extension would reduce this figure to £42, and the ultimate extension would still further reduce it to £31 10s. In addition to the foregoing, it is necessary to provide mechnical means of handling coal from the railway siding or canal to the works. Overtures have been made to neighbouring property owners to secure permission and favourable terms to carry out the works, but nothing of a definite nature can be put forward. The maximum cost of this plant, including stores on railway company's land, if the rail scheme is ultimately recommended, would be, approximately, £6,000, which, if carried out, would effect a saving of £250 per annum over cartage on present tonnage, and provide sufficient plant to handle 50,000 tons per annum, when the saving over cartage would be £1,250. The Council has postponed consideration of the matter pending the receipt of a report from the Finance Committee.

Stepney.—The B.C. has approved an estimate of £5,260 for a sub-station in Old Gravel Lane, which is to be submitted to the L.C.C. for its approval, together with plans, &c. The Council has also approved of £500 being taken from the reserve fund for expenditure in connection with the fittings hiring scheme referred to recently in these notes.

Maidstone.—The T.C. has received from the B. of T. an order empowering it to supply current to Turkey Mills and other premises outside the borough.

The charges for current have been revised, and for private dwelling houses the charge is to be a flat rate of 4d. per unit for lighting; 1d. per unit for heating and cooking, or a fixed charge of 6s. 8d. per annum for each 32-watt lamp alight at once, and 1d. per unit for all current consumed, whether for lighting, heating, or cooking; or a fixed charge of 10s. per annum for each 32-watt lamp alight at one time.

Mirfield.—The U.D.C. has applied to the L.G.B. for a loan of £1,058 for E.L. purposes, and £965 for the acquisition of a site for a refuse destructor.

Pontefract.—With reference to the proposed transfer of the E.L. order to the West Riding Tramways Co., Ltd., the company is to pay the T.C. £400, the estimated cost of the promotion of Bill authorising the transfer, and £140 already incurred in obtaining the order. The Council is to have the option of purchasing the undertaking at the end of 27 years at a valuation, but without any allowance for goodwill or monopoly value.

Salford.—Current is to be supplied at tariff prices to the Globe Cop Dyeing Works, Ltd., in Garden Street, Lower Broughton. Sir A. B. W. Kenuedy is to investigate and report, at a fee of 200 guineas, upon a scheme for the alteration of the existing generating plant at the electricity works, Frederick Road. Arrangements have been authorised for carrying out certain experiments in connection with the scheme.

South Africa.—It is proposed to extend the electric supply mains and street lighting in Pretoria West, at a cost of £6,000. The additional street mains amount to about three miles, covering the whole area beyond Rosetta Street and between Church and Mitchell Streets. Street lamps will be placed at all street intersections, amounting to 15.

Southampton.—The borough treasurer reports that the income of the electricity undertaking for the year ended March 31st, 1910, was £37,682, and the expenditure was £17,589. After deducting interest and redemption charges there remained a net profit of £6,548. Of this, £2,500 is to be devoted in the aid of the rates, and a balance of £3,800 is to be carried forward. During the past year amounts totalling £1,150 were charged to the depreciation and renewals fund.

Stoke-on-Trent.—The T.C. has decided that for restricted-hour supply there shall be a uniform charge of 1d. per unit, net cash, by special arrangement with consumers, who are to provide a time switch so arranged that no current is taken during the hours between sunset and 10 p.m. daily.

The Council has decided that energy shall be supplied to large manufacturing premises in the Burslem area at £1 per KW. per quarter demand charge, and ½d. per unit for current consumed for power.

The B. of T. has been asked to consent to an overhead line being erected from the Burslem works to High Lane, Burslem, where building land is being developed, and for this supply a feeder is to provided at a cost of £700.

Stalybridge.—The Joint Tramways and Electricity Board has decided to supply current for Coronation illuminations at 1d. per nnit. From April 1st the charge for current for lighting has been reduced to 3½d. per unit, less 7½ per cent. discount for prompt payment.

U.S.A.—According to the *Electrical World*, the Lehigh Coal Co. has on hand a $10,000,000 project for establishing power plants at its mines for the distribution of electrical energy instead of fuel. It is estimated that 500,000 tons of anthracite dust are wasted every year at the company's mines, and in order to utilise this a start will be made with a plant consisting of three 10,000-KW. units, which it is proposed to enlarge ultimately to 100,000 KW. capacity. The initial cost will be $3,000,000, and the supply will be given to cement and slate industries lying from 20 to 40 miles away, where it is calculated 100,000 H.P. is now in use. The company hopes eventually to deliver energy as far as Philadelphia.

Wood Green.—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow £20,000 in connection with its electricity undertaking, for which it is proposed to obtain a bulk supply from the North Metropolitan Electric Power Supply Co. and distribute it. It is proposed to make the following charges to consumers: 4½d. per unit for private houses; 4d. for shops and public buildings; and 3½d. for large users who would guarantee a certain number of units per year. The engineer, Mr. Spencer Hawes, estimates a profit on the first year of £240. The provisional order runs out shortly, so that in the absence of any extension of the order the company would supply the district, if the Council is not permitted by the L.G.B. to put this scheme into operation. It is interesting to recall the fact that a few years ago the same Council went to the L.G.B. for sanction to obtain a loan of £50,000 or £60,000 for the purpose of generating and distributing electricity, but the higher authority rejected the proposal. As the generation scheme failed the distribution scheme is now being submitted.

Worcester.—The Council has had before it the engineer's proposals for substituting three-phase for single-phase A.C. supply. It is also proposed to further deepen the river in order to improve the efficiency of the turbines. The estimated cost of the new plant proposed is £5,400, but the total prospective expenditure, including a new cable from Hylton Road works to Lowesmoor, is £7,100.

York.—The Electricity Committee of the T.C. reports that it will shortly be necessary to provide a new battery, booster, regulator and other plant, at an approximate cost of £1,400. It is proposed to purchase this out of the surplus profits, which for the past year are estimated at £1,569.

TRAMWAY and RAILWAY NOTES.

Belfast.—At a special meeting of the Law Committee of the Corporation, it was intimated that Mr. Lynden Macassey, B.L., has made his arbitration award in connection with the purchase of the Cavehill and Whitewell tramway's system by the Corporation. We understand that the arbitrator fixed the price at £56,155. It will be remembered that the Corporation originally agreed to purchase the undertaking at £60,000, but that the Bill for doing this was defeated in the House of Commons through the action of the Irish Nationalists, who had made the purchase of the tramway a political matter for some reason of their own. When the expenses of the arbitration, &c., have been paid, the Corporation will have paid over £70,000 for the undertaking, not to mention nearly a couple of years' losses on the non-purchase of the line. In other words, the Socialists and Nationalists have put more than an additional £10,000 on the ratepayers by their foolish action.

Birkenhead.—An arrangement has been made between Sub-Committees of the Tramways and Electricity Committees, in reference to placing under the control of the Electricity Committee all the generating stations of the Corporation.

Bradford.—The new railless trolley system from the top of Sticker Lane at Dudley Hill, down to Laisterdyke, Bradford, is expected to be opened in about a month.

The Tramways Committee having declined to accede to the request of the Leeds Corporation that the through fare between Leeds and Bradford should be either reduced from 6d. to 5d., or divided on a mileage basis, the Leeds Committee proposes that the matter should be referred to arbitration, and that the President of the Municipal Tramways Association for the time being shall be appointed arbitrator.

For the year ended March 31st last, the Corporation tramways department established a record. The traffic receipts amounted to £264,075, compared with £254,026 in the previous year, an increase of £10,049. The receipts per car-mile were 11·6d., against 11·21d. in the previous year, and the car-miles run were 25,033 over those of the previous year; the passengers carried were 52,919,559, an increase of 2,400,746 over the previous year.

Canada.—As a means of settling the questions in dispute between it and the city, the Winnipeg Electric Railway, through its president, Sir William Mackenzie, has offered its railway, electric light and gas properties to the city as a going concern. The basis on which control is offered is said to be $250 a share, whereas the present market quotation is $190. The cost to the city would be over $15,000,000. The Mackenzie interests agree to purchase from the city 15,000 H.P. as soon as the hydroelectric station now being erected at Point Du Bois Falls is completed, on condition that the Winnipeg Electric Railway be permitted the exclusive right to engage in commercial lighting. It is claimed that the price offered for the energy will pay interest on the city's entire investment in the municipal plant mentioned.—*Electrical World.*

Doncaster.—The T.C. in Committee, on March 30th, decided upon the tramway scheme to the Woodlands Model Village, subject to the consent of the Light Railway Commissioners and negotiations with the C.C. The tramway will be laid on a sleeper track on the grass margin of the road, and will be 3½ miles in length. Including the necessary cars the estimated cost is £30,000.

Glasgow.—It is reported that the valuation of the tramway undertaking by the Assessor of Railways and Canals for the year 1911-12, has been fixed at £247,663, as against £258,838 for the previous year.

Halifax.—The total receipts on the tramways for the year ended March 31st were £93,000, an increase of over £30,000; the passengers carried amounted to 17 millions. The increase in receipts is about 3·3 per cent. The profits on the year's working will exceed £10,000, which is regarded as highly satisfactory.

Hull.—The Tramways Committee has decided to extend the Hedon Road tramways to Marfleet Avenue district, a growing suburb in the vicinity of the new joint dock.

Leeds.—The Corporation Tramways and Electricity Committee has passed a resolution expressing the opinion that it is undesirable to adopt a general parcel-carrying business on the tramway cars.

London.—Good progress is being made by the L. & N.W. Railway Co. with the doubling of the line from Willesden to Watford, which is a preliminary to the long-talked-of electrification scheme between Euston and Watford.

New Zealand.—A municipal tramway board proposes to raise a loan of £24,000 for the construction and equipment of additional electric tramways. A poll of the ratepayers is shortly to be taken.—*Board of Trade Journal.*

Scarborough.—The Scarborough Tramways Co. announce that the service of cars will be resumed on Monday next, the 10th inst. No decision has been given yet by the B. of T. on the application of the Corporation that the powers of the Tramway Co. be determined, owing to its failure to maintain a tramway service during the winter months. The restarting of the cars on Monday, therefore, is not taken as having any bearing on the question at issue as between the company and the Corporation. Meanwhile, it will be recalled that, in conformity with an appointment made by the Scarborough justices, a Receiver will receive all moneys on behalf of the mortgagees, Messrs. Edmundson's Electricity Corporation.

Nantwich.—The Light Railway Commissioners have decided that they cannot deal in their capacity as Commissioners with the proposed light railway from Mouldsworth over the Chester Vale, *via* Tarporley to Nantwich, as there is evidence that there would be substantial competition with the London and North-Western Railway.

Newcastle-on-Tyne.—An unusual incident happened at the meeting of the City Council on March 28th, when the estimates for the next financial year were under consideration, and the chairman of the Tramways Committee declared his intention to resign. The estimates, as originally presented, totalled £692,080, against an income of £662,212, so that there was an apparent deficiency of nearly £30,000; but at a previous meeting it had been shown that there were items that would increase this figure to £40,000. The estimates were sent back to the Committees, and as a result of their reconsideration and the action of the Council, they were reduced by £12,806. To meet the deficiency, the Tramways Committee had offered to contribute £6,000. At the meeting on March 28th, when the Tramway Committee's estimates were before the Council, Sir Henry Newton moved to reduce them by £12,000. He said that the undertaking was an absolutely substantial one. They had a surplus, called a renewal fund, amounting to £95,000, and was there any reason why the amount should not be £80,000? Sir Joseph Ellis seconded. Mr. Rodgers, the chairman of the Tramways Committee, said he declined to buy popularity by any parrot cry. He referred to the time when the undertaking was losing £300 per week, and when they were building expenditure on expenditure, Already as ratepayers, they gave the city £12,000 a year, and they proposed to give £6,000, which he thought was a very good offer. If they gave £12,000, they would deplete their renewal fund. Practically every penny expected next year in profit was earmarked. The Lord Mayor (Sir W. H. Stephenson) said all they could do was to ask the Tramways Committee, out of the generosity of their souls, to give either £6,000 or £12,000 out of their funds. Mr. Rodgers said it would be the greatest mistake the Council had ever made if they depleted the tramway funds. The proposal that £12,000 should be voted out of the tramways was agreed to by 39 votes against 14. Mr. Rodgers: "I am sorry, my Lord Mayor, but that finishes my connection with the Tramways Committee." He then walked out of the chamber.

Rochdale.—The weekly returns of the Corporation tramways show total receipts up to last week of just over £60,000 for the past municipal year, and it is anticipated when the accounts are balanced that the accounts will show a profit, though it may be only small.

At a meeting of the Tramways Committee last week, a letter was read from the Milnrow District Council protesting against the delay in connection with the tramways extension to Milnrow. It was mentioned that the provisional order cost £635, whereas Rochdale only promised £450 on that account. A resolution was passed that the work of extension be commenced at the earliest possible date. A commencement has been made with the track work in connection with the extension of the Rochdale tramway system from Shawforth to Bacup, and traffic between Rochdale and Bacup, and *vice versa*, will be possible by Whitsuntide.

Salford.—The motormen and conductors in the employ of the Corporation are to receive an increase in wages, which will amount in the aggregate to £1,200 per year. The men have decided not to apply for any further advance until 1914.

Southampton.—The general manager of the tramways department reports that since the first equipments for the new cars were ordered a year ago, an improvement has been brought out in the motors by the makers of the same. This involves the use of commutating poles in the field circuit and a difference in the lubrication system as far as the armature bearings are concerned. The makers are to incorporate the new arrangements in the motors for the six cars which they have now started to build, as economy in current consumption and lubrication will be effected. The increased cost will be £5 per equipment. Motors so equipped are working in Leeds, Nottingham, Bolton, Birmingham, Huddersfield, and other places.

South Lancashire.—A correspondent writes that the South Lancashire Tramways Co. is contemplating extending its system from Farnworth through Stoneclough, Ringley and Outwood to Whitefield, joining up with other tramway systems there.

South Shields.—The receipts of the Corporation tramways during the year ended March 31st last, amounted to £28,946, as compared with £29,052 in the previous year, a decrease of £106. The number of passengers carried was 7,275,898, as compared with 7,273,776, an increase of 2,122. The average takings per car-mile was 8·60d., as against 8·64d. in the preceding year. In respect to the running powers possessed by the Jarrow and District Electric Traction Co. over a section of the Shields Corporation's system, the Tramways Committee of the latter has recommended the Council to give the Traction Co. a calendar month's notice to terminate the agreement on June 17th, unless the company is prepared to accept a reduced payment per car-mile.

Wrexham.—The T.C. has decided to borrow £800 for the provision of a traction battery, with necessary switchboard and reversible booster, at the electricity works.

TELEGRAPH and TELEPHONE NOTES.

Aberdeen.—The telephone service is being extended from Banchory to Braemar, and will be open by the beginning of June. The trunk line between Ballater and Braemar has been completed. The estimated cost of the extension is over £10,000.

Continental Telegraphic Communication.—Answering a question as to the resolution passed by the Associated Chambers of Commerce, advocating a system of urgent telegrams to the Continent for extra payment, Mr. H. Samuel says he will give full consideration to the resolution. Since June, 1909, multiplex apparatus similar to that previously used in the French and Swiss circuits has been introduced into the Netherland circuits, and experiments are in progress with a view to a further extension in the use of such apparatus, especially over the longer cables between England and Germany. This presents certain technical difficulties, which his officers are endeavouring to surmount in concert with the officers of the German Administration.

Russia.—A company has lately been formed in Moscow, named the Gesellschaft für Telefon Anlagen, to manufacture telephone material.

Telephones in the United States.—Rumours of proposals to bring about amalgamation of the telephone interests in the United States continue, and the last issue of the *Electrical World* gives some particulars of the terms offered by the New York Telephone Co. to the Independent systems in northern New York, the purchase price to be paid in cash. It is stated also that the American Telephone and Telegraph Co.'s engineers have perfected an improvement on the Pupin system, which increases the carrying capacity of long-distance lines by 40 or 50 per cent. A line is now completed between New York and Denver, a distance of nearly 2,000 miles. The outlay of the Bell companies on construction during 1911 is estimated at about 12 millions sterling.

Trans-Atlantic Cables Protection.—Mr. Boland asked the Postmaster-General if he could state what steps had been taken, in view of the approach of the spring fishing season, to protect the trans-Atlantic cables with their shore ends at Waterville, Ballinskelligs and Valentia respectively, from the damage caused by steam trawlers; what system of inspection, if any, of the trawling gear had been adopted, and whether the cable companies had been satisfied that the proposed precautions were adequate. The Postmaster-General, in reply, said the system of inspection of trawling gear recommended by the Committee which considered this question in 1908 was now in regular operation at the ports concerned throughout the United Kingdom. He understood that the system was working smoothly, and that the trawlers generally were showing readiness to give effect to the representations of the inspectors of the Fisheries Department when they pointed out that the gear was likely to injure submarine cables. Though the cable companies would naturally prefer more stringent measures, he had no reason to believe that they were dissatisfied with the working of the system.

Wireless Telegraphy.—It is reported that since April 1st French warships are allowed to transmit private telegraphic messages by means of their wireless installations.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—May 8th. Battery of accumulators, with boosters and switchboards, for the Melbourne City Council. See "Official Notices" February 24th.

April 21st.—120 5-ampere 200-volt A.C. watt-hour meters, for the Melbourne City Council. See "Official Notices" to-day.

May 16th.—10,000 telephone protectors, for the P.M.G.'s Department in Victoria. See "Official Notices" March 31st.

May 30th.—One portable petrol-driven desiccating plant, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

May 31st.—7,000 insulators and wire and line material, for the P.M.G.'s Department in South Australia. See "Official Notices" to-day.

June 14th.—Switchboard, common-battery, multiple, for the P.M.G.'s Department in South Australia. See "Official Notices" February 3rd.

June 14th.—Branching multiple magneto lamp-signalling switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" February 3rd.

July 25th.—Deputy-P.M.G., Melbourne. Twelve sections of a branching multiple magneto lamp signalling switchboard, &c., or one automatic or semi-automatic switchboard, for the P.M.G.'s Department in Victoria. See "Official Notices" March 24th.

Belgium. — April 12th. The Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the supply and laying of the underground armoured electric cables required in connection with the light railways in the Charleroi district.

April 26th.—The Provincial Government authorities at Mons are inviting tenders for the concession for the construction and working of an electric tramway between Charleroi and Couillet-Queue.

Bulgaria.—April 19th. Tenders are invited for the supply of Varna with electric light. Specifications 30 francs, from the "Burgermeisteramt der Stadt Varna," Varna. Deposit £2,000. A copy, in Bulgarian, may be seen at the Board of Trade C.I. Branch in London.

Bury.—April 21st. Wiring and fitting for the electric lighting of the Chamber Hall Power Station, for the Corporation. See "Official Notices" to-day.

Cavan.—April 10th. Generating plant and wiring at St. Patrick's College and the Bishop's House, for the Trustees. See "Official Notices" March 24th.

Derby.—Inverted rotary converters, E.H.T. cables and E.H.T. switchgear, for the Borough Electricity Department. See "Official Notices" to-day.

Dudley.—April 9th. Lubricating oils for a year, for the Corporation Electricity Department. See "Official Notices" March 31st.

April 19th.—Stores for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

Eccles.—In compliance with the regulations of the Home Office, five generator and feeder panels and synchronising gear are to be provided at the generating station. Tenders are to be invited for these.

Edinburgh.—April 17th. Cast-iron pipe work for condensing water, &c., for the Corporation Electricity Supply. See "Official Notices" to-day.

Egham.—April 24th. Two high-speed Diesel oil engines, coupled to 100-KW. single-phase alternators, with exciters, piping, &c.; one 4-ton overhead traveller, and main high-tension switchboard, for the Egham and District Electric Lighting Co., Ltd. See "Official Notices" to-day.

Germany.—April 10th. The Lighting Committee of the Municipal Council of Bremen is inviting tenders for a 300-KW. motor-generator.

Glasgow.—April 24th. Steam turbo-alternator, with condensing plant, for the Corporation tramways. See "Official Notices" March 17th.

Hornsey.—April 24th. Flame arc lamps, for the T.C. See "Official Notices" March 31st.

London.—April 12th. Electric fittings and tubes for three years, for H.M. Office of Works. See "Official Notices" March 31st.

ST. PANCRAS.—April 12th. (*a*) Arc lamp carbons; (*b*) motor-generator and balancer, for the B.C. See "Official Notices" March 24th.

300 D.C. and A.C. meters and 500 interlocked ironclad fuse-switches or ironclad switches connected to double-pole ironclad cartridge fuses, sizes from 15 to 250 amps., for the Committee of the Electrical Exhibition, Olympia. See "Official Notices" March 31st.

HAMMERSMITH.—April 12th. Street lanterns for incandescent lamps, for the B.C. See "Official Notices" to-day.

Manchester.—April 11th. 350-KW. static transformer, for the T.C.: F. E. Hughes, Secretary, Electricity Department, Town Hall (returnable deposit of £1 1s.).

Newport.—April 8th. Lubricating oils for the Corporation Electricity and Tramways Departments. See "Official Notices" March 24th.

Norway.—April 21st. Norwegian State Railway Authorities. Telegraph material, including galvanised-iron wire, hemp, sal-ammoniac, insulators, carbon plates, insulated copper cable and wire. Tenders, marked "Anbud paa telegrafmateriel," to "Styrelsens Expeditionskontor, Statsbanerne," Christiania. Copies of conditions, &c., to be seen at the Commercial Intelligence Branch of the Board of Trade.

Rochdale.—April 10th. Stores for the Corporation Tramways Department for a year; J. S. D. Moffet, General Manager, Mellor Street (returnable deposit of 5s.).

St. Helens.—April 20th. One 1,500-KW. high-pressure turbo-alternator, with condensing plant and switchgear, for the Corporation Electricity Committee. See "Official Notices" March 31st.

Turkey.—April 12th. Rubber-covered electric cables, &c. Further particulars from the Inspectorate General of Technical Works and Fortified Places, Ministry of War, Constantinople.

June 14th.—H.M. Consul-General at Constantinople reports that tenders are invited by the Turkish Ministry of Public Works, Constantinople, for a concession for the public distribution of electrical energy and for electric tramways in the town of Jerusalem and its suburbs. A deposit of £T2,000 (£1,800) is required with each tender, and the tenderer must also supply proof of his financial and technical ability to perform the work. Tenders, in sealed envelopes, marked "Ministère Impérial Ottoman des Travaux Publics: Adjudication de la concession de la distribution publique d'énergie et des tramways électriques de Jérusalem," will be received at the Ministry up to 2 p.m. on June 1st/14th. Local representation is essential in the case of Turkish Government contracts. A list of British commission agents established in Constantinople may be obtained, and a copy of the specification (in French) relating to the Jerusalem contract seen, by British firms at the Commercial Intelligence Branch of the Board of Trade, London.

H.M. Consul-General also reports that the adjudications for the concessions of electric tramway systems at Adrianople and Adana have both been postponed until May 2nd.

Stoke-on-Trent.—Electricity works plant, for the Borough Electricity Supply Committee. See "Official Notices" March 24th.

Torquay.—April 13th. Turbo-generator, condensing plant and switchgear, motor-generator and switchgear, and electrically-driven feed pump, for the T.C. See "Official Notices" March 24th.

Walthamstow.—April 28th. Cooling tower and switchboard extension, for the U.D.C. Electricity Department. See "Official Notices" to-day.

York.—April 11th. Reversible booster, switchboard and replating of storage battery, for the Corporation Electricity Department. See "Official Notices" March 24th.

CLOSED.

Accrington.—The Electricity Committee has conditionally accepted the tender of the Chloride Electrical Co., Ltd., for the installation of a new storage battery at the electricity works, for £1,709, less about £160 for the lead in the old battery.

Messrs. Stephenson & Son's tender for installing electric light at the tramway shed has been accepted.

Barrow.—The T.C. on Monday approved the placing of contracts for the electricity works as follows:—

Oils.—Jas. Light & Son, Ltd.
Copper wire.—Thos. Bolton & Sons, Ltd.
Shellac varnish, lacquer, &c.—W. Drysdale.
Insulating compound.—A. Duckham & Co., Ltd.
Tumbler switches, lampholders, &c.—H. A. Jackson & Co.
Tin-lead fuse wire, lead wire and solder.—Ward & Goldstone.
Carbons.—W. Geipel & Co.
Arc lamps, globes and shades.—The City Glass Co.
Joint-boxes.—British Insulated and Helsby Cables, Ltd.
Electricity meters.—Chamberlain & Hookham, Ltd.
Electrolytic Midget meters.—Reason Manufacturing Co., Ltd.
Tantalum and metallic-filament lamps.—Drake & Gorham, Ltd.
Carbon-filament lamps.—Brush Electrical Engineering Co., Ltd.
Earthenware pipes and troughs.—Doulton & Co., Ltd.
Meter boards.—E. Last.
Pavement frames and covers.—W. T. Henley's Telegraph Works Co., Ltd.
Rubber gloves.—L. Andrew & Co.
Steel conduit.—Simplex Conduits, Ltd.
Brass saddles and pins.—General Electric Co., Ltd.

Belgium.—Five concerns—two German, two Belgian and one British (the latter being Callender's Cable and Construction Co., Ltd.)—submitted tenders to the Société Nationale des Chemins de Fer Vicinaux for the supply of the armoured underground cables required in the Brussels district, the lowest being that of the Suddeutsche Kabelwerk Gesellschaft, of Mannheim.

Croydon.—The B.C. has accepted the tender of Mr. W. J. Bishop for the annual supply of electrical fittings.

Dartford.—The U.D.C. has accepted the tender of Messrs. E. Green & Son for the replacement of the economiser sections at the electricity works, at £130.

Derby.—The T.C. has accepted the tender of the British Westinghouse Co., Ltd., for 17 ½-H.P. motors for hire, at £89.

Dudley.—The T.C. has accepted the tenders of the Stourbridge Glazed Brick and Fireclay Co., and the Earl of Dudley, for slack coal for the power station, at an average price of 4s. 10d. per ton, for a year.

Eastbourne.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for the annual supply of meters.

Eccles.—The T.C. has accepted the tender of Messrs. James Howden & Co., Ltd., for a 500-KW. set consisting of a Howden steam engine, Bruce Peebles alternator and exciter, and a Körting Bros. condenser, at £2,581.

Germany.—Messrs. F. Eberhardt & Co., of Bromberg, have submitted the lowest tender for an electrically-operated locomotive turntable for the Prussian State Railway authorities, at Posen.

Glasgow.—The T.C. has accepted the offer of Messrs. Grindlay, Ross & Co., amounting to £48, for the installation of a generator in Whitevale Baths, with a view to preventing fluctuations of pressure.

Gloucester.—The T.C. has accepted the following tenders for additional generating plant, &c.:—

Willans & Robinson, Ltd.—Steam turbo-generator, £3,498.
Phœnix Dynamo Manufacturing Co.—Motor-generator, £394.
British Westinghouse Electrical and Mfg. Co., Ltd.—Switchgear, £138.
Sloan Electrical Co.—Arc lamp carbons, £71.

The tender of Messrs. Sully & Co. has been accepted for six months' supply of rough small steam coal from the Lightmoor Colliery, at 7s. 9½d. per ton.

Grimsby. — The T.C. has accepted the tender of Crompton & Co. for supplying electric motors for hiring out, at £322.

Halifax.—The T.C. is to be recommended to accept the tender of Messrs. Balcke & Co. for a water-cooling tower at the electricity works, at £814.

Hull. — The Tramways Committee of the T.C. has accepted the tender of Messrs. Walter Scott, Ltd., of Leeds, for 250 tons of tram rails (Sandberg quality), at £7 6s. 6d. per ton; 250 tons of sole plates at £8 5s. per ton; and 250 tons of fish plates, at £9 15s. per ton.

Johannesburg.—According to the *South African Trade Journal*, the following tenders were received for the supply of 13¾ miles bare copper wire, 80 isolating links, and nine oil-break switches required by the Gas and Electric Supply Department :—

	Copper wire. Per lb.		Isolating links. Per lb.		Country of origin.
	Local.	Imported.	Local.	Imported.	
	s. d.	s. d.	s. d.	s. d.	
Telegraph Manfg. Co. ..	0 9½	0 8⅞	25 0	—	Gt. Britain
Henley's Telegraph Co.	0 9½	0 9½	—	—	"
Western Electric Co. ..	—	0 9	—	14 9	"
S.A. Genl. Electric Co. ..	—	—	20 0	20 0	"
Barder & Co.	—	0 9½	—	19 0	"
Barder & Co.	—	0 9½	—	19 0	Germany
Davies & Co.	0 9½	—	17 6	—	Gt. Britain
Brit. Westinghouse Co. ..	—	—	—	21 0	"
Brit. Genl. Electric Co. ..	—	0 9½	25 0	27 6	"
A.E.G. Electric Co., Ltd.	—	0 9	18 0	—	Germany
Siemens, Ltd.	—	0 9½	—	25 0	Not stated

	Oil-break switches.		Country of origin.
	Local.	Imported.	
S.A. General Electric Co.	£7	—	U.S.A.
Barder & Co.	—	£10 8	Germany
Davies & Co.	—	12 0	Gt. Britain
British Westinghouse Co.	—	17 0	"
British General Electric Co.	—	6 0	"
A.E.G. Electric Co., Ltd.	—	12 10	Germany
Siemens, Ltd.	—	9 19	Not stated

The town electrical engineer reported to the controller of stores and buyer on the tenders received :—

"*Isolating Links.*—With regard to the isolating links, the cheapest offer is that of the Western Electric Co., at 14s. 9d. each, but the delivery is no less than 14 weeks. As the firm stated in their tender that it may be possible for certain links to be delivered from stock, I have been in communication with them on the matter, and find that not only can only 12 be delivered from stock, but that the price of these will be increased by about 2s. each. As the links are urgently required, it will be necessary, therefore, to consider the next lowest tender; this is from Messrs. H. Davies & Co. for links at 17s. 6d. each, delivery from stock. A large number of this type of link are already in use on the distribution system and are proving highly satisfactory, and I have no hesitation in recommending the acceptance of this firm's tender.

"*Oil-Break Switches.*—The same remarks apply to the cheapest tender in this case, that of the British General Electric Co., Ltd. Not only is the delivery the longest of any tender, but I also note that the "trip" coils of the switch are operated by series transformers. This is an additional complication not included in the switches offered by the next cheapest tenderers, the South African General Electric Co. This firm supplied us with a number of similar switches a few months ago, and they have proved highly satisfactory. I shall be glad, therefore, if you will recommend the acceptance of the tender of the South African General Electric Co., Ltd., for nine 200-amp. 4,500-volt oil-break switches at £7 each, delivery to be from stock.

"*Bare Copper Wire.*—With regard to the bare copper wire, I recommend the acceptance of the lowest tender, that of the Telegraph Manufacturing Co., at 8⅞d. per lb."

The tenders accepted were :—

(*a*) Messrs. H. Davies & Co., supply of 80 isolating links, at 17s. 6d. each.
(*b*) South African General Electric Co., supply of nine oil-break switches, at £7 each.
(*c*) Telegraph Manufacturing Co., No. 10 bare copper wire, at 8⅞d. per lb.

Kendal.—The T.C. has accepted the tender of the British Insulated & Helsby Cables, Ltd., for an underground feeder, at £940.

Leyton.—The U.D.C. has accepted the following tenders :

Reavell & Co.—Air compressor, £24.
Headland & Headland.—Electric light repair for schools, west side of Great Eastern Railway.
E. H. Grimshaw & Son.—Electric light repair for schools, east side of Great Eastern Railway.

London.—Stepney.—The B.C. Electricity Department received the following tenders for the supply of fuse-boxes :—

Siemens Bros. & Co., Ltd.	(recommended) £280
Lucy & Co., Ltd.	284
B.I. and Helsby Cables, Ltd.	301
Henley's Telegraph Works Co., Ltd.	302
Crompton & Co., Ltd.	316
Reason Manufacturing Co., Ltd.	375
Edison & Swan United E.L. Co., Ltd.	376
Electric and Ordnance Accessories Co., Ltd.	424
Johnson & Phillips, Ltd.	480
E. & F. Moy, Ltd.	494
A. Reyrolle & Co., Ltd.	(Informal)
Dorman & Smith	(Unable to tender)
Veritys, Ltd.	" "

Messrs. Reyrolle & Co. are to supply nine panels for the Limehouse station and Wapping sub-station, at £125 each.

Camberwell.—The Guardians have accepted the tender of Crompton & Co., Ltd., at £34 10s., for the supply of a motor for ice-making.

The contract for electrical work at the Premier Flour Mills, Victoria Dock, for Messrs. Joseph Rank, Ltd., has been secured by Mr. H. J. Godfrey, of Balham.

Pretoria.—For the supply of 3,000 tungsten lamps of 50 C.P. and 1,000 lamps of 100 C.P., made to specification, the following tenders were received by the T.C. :—

	40 C.P.	100 C.P.
A.E.G. Electric Co.	2/3	3/3
British General Electric Co.	2/10	3/9
Westinghouse Electric Co.	3/6	6/6
Siemens, Ltd.	—	4/6½

The tender of the A.E.G. Electric Co. was accepted.—*South African Trade Journal.*

Reigate.—The T.C. has accepted the following tenders :

Diesel Engine Co., Ltd.—Two Diesel oil engines, coupled to two 100-KW. single-phase alternators, with direct-coupled exciters, pumps, tanks, and accessories, £4,547.
British Westinghouse Co., Ltd.—Main switchboard for 2,500-volt alternators and five feeders, £485.

Rugby.—The U.D.C. has accepted the tender of W. T. Henley's Telegraph Works Co., Ltd., for cables for extensions.

Salford.—The B.C. has accepted the following tenders for annual supplies to the Electricity Department :—

H. G. Mayer & Co., Ltd.—Motor carbon brushes.
Sykes & Sugden.—Joint boxes.
W. H. Keys, Ltd.—Refined Trinidad bitumen.
Albion Clay Co., Ltd.—Stoneware conduits, pipes, &c.
H. R. Mansfield.—Stoneware conduits.
W. Turner (Ardwick), Ltd.—Asphalt bridges.
Reason Manufacturing Co., Ltd.—Maximum demand indicators.
Eckstein, Heap & Co.—Ammeters.
W. Bateman & Co., Ltd.—Arc lamp globes.
General Electric Co., Ltd.—Carbon-filament lamps.
Andrew & Sutor.—Arc lamp carbons.
Lancashire Dynamo and Motor Co., Ltd.; General Electric Co., Ltd.; Electric Construction Co., Ltd.—Electric motors.
Ferranti, Ltd.; Royce, Ltd.—Motor starters.
J. Wheeldon & Sons, Ltd.—Meter boards, &c.
C. Jennings & Co.—Casing and capping, motor starter boards, &c.
British Insulated and Helsby Cables, Ltd.—Service fuse boxes.
J. H. Tucker & Co.—Switches.
Johnson & Philips, Ltd.—Copper fuse wire and strip, &c.
North British Rubber Co., Ltd.—Rubber caps for cables.

Sculcoates.—The B.of G. has accepted the tender of Mr. H. Hyde, of Hull, for electrical repairs for a year.

Southampton.—The T.C. has accepted the tender of Messrs. McWhirter, Roberts & Co., for electric lamps for the Water Department.

Wakefield.— Mr. Walter Robb has been appointed to carry out the electrical work and supply the electrical fittings required at the Workhouse during the ensuing year.

Wrexham.—The T.C. has accepted the tender of Hayward Bros. & Eckerstein, Ltd., of London, for a switchboard platform and gangway at the electricity works, at £101. The only other tender received was from the St. Pancras Ironworks Co., Ltd., at £122.

York. — The Electricity Committee of the T.C. has accepted the following tenders :—

British Thomson-Houston Co., Ltd.—1,000-KW. turbo-alternator, converters and switchgear, £7,451. (The Committee has power to negotiate with the firm to increase the size of the turbo-alternator to 1,250 KW., at a corresponding increase of the tender.)
Messrs. Babcock & Wilcox.—Water-tube boiler, automatic stoker, and pipe work, £2,080.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, April 10th. At the Armstrong College, Newcastle. Discussion on "Test-Room Equipment," to be opened by Mr. E. Fawssett.

Institution of Electrical Engineers (Glasgow Local Section).—Tuesday, April 11th. At 8 p.m. At 207, Bath Street. Ordinary meeting.

Institution of Electrical Engineers (Students' Section).—Wednesday, April 12th. At 7.45 p.m. Paper on "The Present Position of Electric Traction on Main Lines in Europe," by Mr. C. P. Sparks.

Institution of Electrical Engineers (Birmingham Local Section). — The meeting arranged for April 13th has been postponed.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued :—

Commanding Officer—Lieut.-Col. H. M. Leaf.

Monday, April 10th.—"A" Company. Infantry drill, 7 to 7.30 p.m.; technical drill, 7.30 to 10 p.m.
Tuesday, April 11th.—"B" Company. Technical drill, 7 to 10 p.m.
Thursday, April 13th.—"C" Company. Recruits' infantry drill, 6.30 to 7.15 p.m.; technical drill, 7.15 to 8.30 p.m.; company drill, 8.45 to 9.45 p.m. (Millbank).
Friday, April 14th.—"D" Company. Recruits' infantry drill, 6.30 to 7.15 p.m.; technical drill, 7.15 to 10 p.m.
Easter Holidays.—Headquarters will be closed for drill from April 12th to April 19th (both days inclusive).

(Signed) J. H. S. Phillips, Major, L.E.E., (for) Adjt.

NOTES.

The "Electrical Review" for April 14th.—As is usual in Good Friday week, our next issue will be published on Wednesday morning, April 12th, and we shall be glad if our friends will kindly take note of the following arrangements.

Letters for our *Correspondence* columns must be received by Monday morning (first post), and notes and general news in the course of the morning of the same day. Special late news will be welcomed up to Tuesday morning.

Our *Advertisement Department* announces that new copy and alterations to existing displayed advertisements should be received not later than to-morrow, Saturday morning (April 8th); Official Notices and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday, 11th inst.

Inquiries.—Makers of "Marmorite," and of Uviol lamps, are asked for.

Prompt Delivery.—It is almost needless to emphasise the good impression which the prompt fulfilment of an order creates. A good many instances of smart delivery come to our notice at different times, and with a view to enabling someone to go one better, we record the following:—The Electrical Co. received a telephonic order from Wellingborough for an 8-H.P. motor, slide rails and starter at 10.15 a.m. on March 22nd; these were dispatched by the 12.15 train, arriving at Wellingborough at 2 p.m., were on the site at 2.30 p.m., and the motor was fixed and running at 4 p.m. We may add that payment was equally prompt.

Football.—The Siemens Dynamo Works played the Dalston Lamp Works on Saturday, and the former, monopolising the play, led by 3 to 1 at half-time. Keeping up the pressure in the second half, the Dynamo Works won by 4 to 2. The Dynamo Works was a scratch 11, whereas the Lamp Works have a regular team. The result augurs well for the club, which the former propose forming next season.

A Long-lived Osram.—All things come to an end at last—even our 100-C.P. Osram has run its course. The lamp was put on circuit in our publishing office on March 23rd, 1908; it was rated at 125 watts, for 205 volts, and was run on the Charing Cross Co.'s 200-volt supply. It was used practically every working day, averaging over 50 hours a week, and it was all right when switched off on April 3rd, but refused to burn on the following morning, so that whether its failure was due to old age or to a mechanical shock is uncertain. In any case, it had amply earned a rest, for it had burned for an aggregate period of about 8,000 hours. We believe that longer lives have been recorded, but this example of longevity, which has come under our immediate observation, may not be without interest.

Liverpool Tramway Staff.—The Liverpool tramway officials, with the members of the Tramways Committee, were the guests of the Lord Mayor and Lady Mayoress at a reception at the Town Hall, Liverpool, on Thursday, March 30th. An entertainment, including the presentation of three short plays, followed in the ball-room.

Institute and Lecture Notes.—At a joint meeting of the Scottish Branches of the National Association of Colliery Managers and the Association of Mining Electrical Engineers, held in Glasgow on April 2nd, Mr. Robert Nelson, H.M. Electrical Inspector of Mines, read a paper on "Electricity in Mines; the Avoidance of Accidents." Mr. Nelson explained that electrical accidents in mines fell naturally under three heads—ignitions of firedamp, underground fires, and electric shock. Dealing with these three heads, he said that between January 1st, 1905, and December 31st, 1910, electric shock below ground was responsible for 53 recorded accidents and 55 deaths. During the same period ignitions of firedamp and underground fires caused by electricity had together been responsible for six accidents, causing 12 deaths. After analysing the circumstances of the 53 accidents, Mr. Nelson said it was remarkable that the mere provision of an efficient connection to earth would have avoided two-fifths of the total number of electric shock accidents in mines; but it was, perhaps, more remarkable still that such a provision, together with proper attention to the insulation of those cable systems upon which accidents occurred, would have prevented not less than four-fifths of the total number of accidents. Discussing the safeguards to be observed as regarded the construction and working of apparatus, he advocated careful and constant attention to two main items—(*a*) a sound connection to earth for all outer coverings of apparatus; (*b*) the covering of all live parts, which would otherwise be exposed to contact, with insulating material of such quality and thickness as to obviate danger, coupled with the efficient protection of the insulating material against mechanical damage.

Institution of Electrical Engineers (Students' Section).—On Wednesday next a paper will be read on "The Present Position of Electric Traction on Main Lines in Europe," by Mr. J. B. Sparks. The paper is mainly descriptive, and consists of a record of recent progress in the introduction of electric traction on the main railway lines of Europe. Particulars are given of the electrical equipment of the main-line sections already worked electrically, and of those now being converted.

Mr. J. Wilkinson, M.I.E.E., electrical engineer of the Hull Corporation tramways, recently delivered a lecture on "Electric Tramways and Railways," at Hull.

The Electrical Trades Benevolent Institution.—The annual meeting of this Institution was held at the Hotel Cecil, London, on Wednesday last week, Mr. H. Hirst presiding in the absence of Sir W. H. Preece in South Africa. Mr. Justus Eck presented the report of the year's work, and its adoption was seconded by Mr. R. J. Wallis-Jones. The accounts, as printed in our issue of March 24th, were adopted on the motion of Mr. Oppenheimer, seconded by Mr. Bevis, after a brief discussion, in which it was made clear that the usefulness of the Fund must not be judged merely by the number and amount of the claims met during the year. The present working expenses were being incurred more by the development of the organisation and fund, so as to put it in a strong position to meet future claims for both temporary assistance and pensions, than for these few cases, though great pains are taken fully to investigate their merits. We refer to this point in our leader pages to-day. Messrs. Oppenheimer, Davenport, Bevis, Eck, Hirst, Esson, Gatehouse and Hawes (the new secretary) all took part in this discussion. The meeting gratefully acknowledged a legacy of £100 to the Fund received from the executors of the late Mr. Gustav Byng. The Committee was re-elected, and the name of the retiring secretary, Mr. W. Davenport, was added, thus: W. B. Esson, T. E. Gatehouse, L. Thurnauer, E. Garcke, W. Schmahl, R. Wallis-Jones, W. Davenport. The auditors were also re-elected. The meeting then settled down to the discussion of Rule 2, and this was altered in order to define the intention of the Fund, as explained in our leading article to-day. Since our leader on the subject went to press, we find that in our reproduction of the amended Rule 2 we have wrongly omitted the words "and to their widows and families." A vote of thanks to the chairman closed the meeting.

The following appeal has been issued by Mr. Justus Eck:—

"Dear Sir,—I have pleasure in informing you that Lord Justice Fletcher-Moulton, who has so long been intimately connected with the electrical industry, has kindly consented to act as President at the Festival Dinner of the Electrical Trades Benevolent Institution, to be held on Wednesday, April 26th, at the Hotel Cecil, and I sincerely trust you will indicate your appreciation of this distinguished patronage by enabling him to then announce that the Benevolent Institution has this year received exceptional support.

"During the past five years the Institution has conferred great and immediate benefits on members of a most deserving class when suffering from sickness or distress. With the present year the Institution is within range of calls being made to grant pensions, consequently substantial additions to the capital funds are necessary; bearing this in mind it is with confidence I appeal to all interested in the electrical industry to contribute liberally.

"I regret that absence in South Africa prevents the chairman, Sir William H. Preece, issuing an appeal this critical year, but trust you will support him, although compelled to be absent, by helping the good work forward.

"Justus Eck,
"*Deputy Chairman of the Committee.*

"March 30th, 1911.

"P.S.—Subscriptions should be sent to the Secretary, Mr. F. B. O. Hawes, Balfour House, Finsbury Pavement, E.C."

The Editors in Trouble.—We recently received an ill-written and ill-spelt letter from a correspondent who desired to be known as "Inquirer," and who, under the heading "Well-paid Post Wanted," unburdened his soul on the subject of educational syndicates and publishers, which he evidently regarded as snares for the unwary. Book-learning he condemned as having had the effect of bringing down wages in central station work. Claiming that he had himself studied early and late, and had had "several years' experience in electrical and mechanical work," he deplored the fact that, nevertheless, he could not obtain a post carrying a salary of more than 10s. or 15s. a week, and was still dependent upon his parents. The writer ingenuously added that if any of our readers could tell him "how to obtain one of these well-paid posts," the information would be greatly welcomed by himself and "many other highly-trained" readers.

While we sympathised with our correspondent, we saw no reason why his letter should be published, nor did we discover in it any evidence of the knowledge and ability claimed by the writer, who appeared to be one of the many persons who, being appraised by the world at their true value, vainly dispute the valuation. The sequel is a postcard from the wrathful student, which we give below; it speaks for itself:—

Dear Sir,—

I notice that you have not inserted the Correspondence that I sent to be published last week and you have not even offered a explanation. If your Correspondence Column is only for Manufacturers to advitise their goods why dont you say so? and state what you want or dont want it seems as if now a days any part of the book from Cover to Cover is to flatter advitisers there is precious little News I thought Papers were published for readers and to please them but things seem to be getting the other way about. The Correspondence that I sent was no different in nature to some of that which has been published before. It was a query of great interest to many readers I should be pleased if you will publish it next week or state the reason why

Yours truly
Inquirer.

PS my name and address is not on any account to be published.

Electricity Works Staff Dinners.—Members of the Croydon staff, to the number of about 100, have held their annual dinner under the presidency of Mr. A. C. Cramb, borough electrical engineer; the company included the Mayor of Croydon (Alderman J. Trumble), and Alderman D. B. Miller (Chairman of the Lighting and Electricity Committee). Mr. Cramb referred to the fact that £12,000 had just been contributed by the undertaking to the relief of the rates. He expressed hopes of a further reduction in prices to consumers being made, but that could not be done unless they adopted more modern and economical machinery, and he trusted this would soon be possible. At the same time they were handicapped for the want of extended powers, only obtainable from Parliament, to meet the competition of gas. Alderman Miller pointed out that the department had never cost the ratepayers one farthing.

The Poplar electricity department held its fifth annual dinner last month, Mr. J. H. Bowden, borough electrical engineer and manager, presiding.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Mr. F. W. T. Bradley, shift engineer, with the Kent Electric Power Co., has been presented with a marble timepiece by the staff and employés, on the occasion of his marriage.

Mr. W. F. Stamp, chief assistant at the Devonport Corporation Electricity Works, who is leaving to take up an appointment in Canada, has been presented by the staff with a silver-plated fruit stand, a Thermos flask, and a work on "Electrical Engineering."

Mr. J. Cameron, of Hampstead Electricity Works, has been appointed assistant meter inspector at the Watford U.D.C. Electricity Works.

Presentations have been made to Mr. H. Dowsett and Mr. F. H. Tutt, two pupils at the Windsor Electric Light Works, upon their leaving to take up appointments elsewhere. The former has secured an appointment at the Greenock Corporation electrical works, while the latter has been engaged for similar work by the Horsham District Council.

The Accrington Council has appointed Mr. Ernest Hall shift engineer at the electricity works at £104 a year. Mr. W. P. Holgate will act as a spare shift engineer.

Mr. E. F. Steele has resigned his position at the Salford Corporation electricity works, to take up a position as shift engineer at the Ayr Corporation electricity works.

Mr. H. F. Barnes has resigned his appointment of shift engineer under the Rawtenstall Corporation, in order to take up a similar post with the Great Northern Railway Co.

Mr. J. L. Winter has been appointed manager of Bo'ness electricity works in succession to the late Mr. H. G. Young. Mr. Winter for the past three years acted as chief assistant engineer to the Musselburgh and District Electric Light and Traction Co., Ltd.

Tramway Officials.—Mr. J. T. Taylor, an employé of the Urban Electric Supply Co., left Glossop on March 31st for Canada, where he has secured an appointment in construction work. The previous day, whilst at work on the tramways track, Mr. Whitehead, the track foreman, asked Mr. Taylor's acceptance of a watch, subscribed for by his fellow-workmen and foremen.

General.—Mr. R. J. Browne, M.I.E.E., electrical inspector, P.W.D., has returned to India from home, and is appointed to act as Electrical Adviser to the Government of India during the absence of Mr. J. Meares, M.I.E.E., in England.

Mr. J. W. Meares, Electrical Adviser to the Government of India, arrives in England on furlough early in April. Letters addressed care of H. S. King & Co., 65, Cornhill, E.C., will be forwarded to him.

Mr. F. T. Chapman, B.Sc. (London), Assoc.M.Inst.C.E., A.M.I.E.E., has been appointed to succeed Prof. Buchanan as lecturer in electrotechnics to Faraday House. We are informed that he has had considerable teaching experience at the Leeds Technical School, and for the last 10 years has been engaged in the practical design of continuous and alternating-current dynamos and motors for Messrs. Greenwood & Batley, of Leeds.

The *Financial Times* says that "Mr. J. H. Rider is to succeed Mr. Robeson as consulting electrical and mechanical engineer on the Rand to Messrs. Eckstein. He has recently been elected President of the South African Institute of Electrical Engineers."

The *African World* says that Mr. H. G. Spengel, who has been prominently identified for many years with mechanical and electrical engineering on the Rand, was entertained to a farewell dinner at the Carlton Hotel, Johannesburg, by his professional and other friends, on the eve of a visit to Europe.

Mr. A. L. Ballard, B.Sc. (London), Gold Medallist of Faraday House (1909), has been appointed to the Assistant Lectureship in Electrotechnics at the South African School of Mines, Johannesburg (Transvaal University), at a commencing salary of £300 per annum. Whilst a pupil of Faraday House, Mr. Ballard served the practical part of his training with Messrs. Robey & Co., Ltd., Lincoln, and at the Witton Works of the General Electric Co., Ltd., Birmingham.

Mr. Horace Field Parshall, D.Sc., M.Inst.C.E., M.I.E.E., has been appointed chairman of the Central London Railway, in place of Sir Henry Oakley, who has just resigned that position. In taking this step, the directors have followed the practice which is daily becoming more general in the United States, of entrusting the control of large industrial undertakings to experienced and well-known engineers. Sir H. Oakley, it is said, will remain on the board.

CITY NOTES.

Indian Electric Supply and Traction Co., Ltd.

The annual meeting was held on Tuesday at the offices, Orient House, New Broad Street, E.C., Mr. John G. B. Stone presiding.

The Chairman, in proposing the adoption of the report, said they would see that the company's affairs had taken a very decided turn for the better, although they had not yet reached the dividend-paying stage. When the shareholders were asked to put up the money for developing the business they were informed that the surplus earnings available to meet interest on the debentures offered were at the rate of £1,860 per annum, and they were told that the directors anticipated better results year by year. They would now be glad to know that the surplus for the whole year 1910 proved to be £4,300, of which £2,700 was earned in the second half of the year. Since they last met, the creditors had agreed to take one-half their claims in debentures and to defer payment of the balance till the end of next year; the security for the deferred payment being given in debentures (with interest deferred until that date). By this arrangement, and the issue of additional debentures for cash, the company's financial position had been consolidated and strengthened, and they now had about £12,000 in hand to draw upon as opportunity arose for the extension of the business. Their agents had recommended several small extensions which they thought would materially increase the revenue of the company. The connections to the mains on December 31st last were equivalent to 21,104 8-c.p. lamps, an increase during the 12 months of 5,551 lamps, and since the beginning of this year a further 1,000 lamps had been added. Rather more than 40 per cent. of these connections were for motive power, the demand for which had greatly increased, and this accounted for the lower average price realised, but the increased output had, in conjunction with a lower price for coal, diminished the cost of production from 1·74d. to 1·16d. per unit, so that the margin of profit had increased, as shown by the result of the year's working. The tramway also showed improved results, and the agent's advice to reduce the fares had been justified, for while the number of passengers had been increased by about 80 per cent., the earnings per car-mile had risen by nearly 1d., and the net result was a small surplus in place of the former loss. The cost per car-mile would have shown a decrease, but for the fact that it was found desirable to charge the tramways a fixed rate of 1·5d. per unit for current instead of the bare generating cost which in the previous year had been 1·29d. per unit. This did not affect the total earnings of the company, but made a more correct adjustment between the supply and traction sides of the undertaking. The fact that they were now able to earn a surplus on their very small system of tramway lines indicated the desirability of their considering in the near future the extension of the system to more adequately meet the requirements of the population. The total length of this was only 3½ miles, and they carried 2½ million passengers during 1910. During the year it had been found necessary to open a wiring branch, which under the name of sales department, showed a small profit. The existing wiring contractors, probably through finding the field so restricted, had little inducement to push business, and after much consideration the directors decided to utilise the company's workshop and staff, and to increase the latter for the purpose of fitting up consumers' premises. They did not look for direct profit, but after debiting the department with a full share of management charges the account came out on the right side. Indirectly the department promoted the company's interests by actively canvassing for new customers. The result of the past year's working was more particularly encouraging, as there had been a return of the plague in the United Provinces of which Cawnpore was the centre. It was now less severe in the city itself, but they had had several fatal cases amongst their Indian staff, which had increased the company's difficulties. The business had now reached a position in which they felt that an increase in the European staff was necessary, and they were taking steps to this end. They felt that the company was indebted to the agents and the staff in Cawnpore for the way in which they had developed the business under very trying conditions. Since the close of the year the deliveries of current to customers showed an increase of 112 per cent. as compared with the corresponding period of 1910, and the tramway receipts had increased 23 per cent.

Mr. W. H. Cheetham seconded the motion.

The report was adopted.

Subsequently Mr. K. A. Scott-Moncrieff, at the suggestion of the Chairman, made a short speech as to the progress of the company. He remarked that, at the time he joined the board, he said he thought things would improve, and he was pleased to think that they had turned out even better than he anticipated, particularly the tramway. He thought they owed a great deal to their friends in Cawnpore for having brought that undertaking to the state it was now in. With regard to the question of price, people were apt to say that they were generating electricity at one anna and selling it at six annas, but over and above the cost of

generation there was the charge on interest and capital, and that was a point which they had to watch very carefully. It was an easy matter to build up a load and show a profit on the works costs, and at the same time to tie up the plant so that it could never earn more than a profit on the works cost. That was not the case with their undertaking. The increase in the demand on their plant had not been greater than the increase in the revenue, and they still had a considerable margin of plant available for further increases and further earning on capital account. Some of the £12,000 which had been raised by debentures was being spent in increasing the boiler plant, and they might at any time find a profitable business offered them which would call for the expenditure of the rest of that money. Personally, he would welcome its expenditure, because every pound spent now would bring into active use plant for which at present they had no load.

Willans & Robinson, Ltd.

The accounts for the half-year ended December 31st, 1910, show that after writing off the sum of £4,482 as depreciation; paying £4,178 interest on debenture stock; and crediting £390, the balance from the Queen's Ferry account, the result of the half-year's trading shows a loss of £10,811. Added to the balance £15,269 brought forward from the previous half-year, this brings up the total of the debit standing against the profit and loss account to £26,080. Debentures representing £770 have been redeemed during the half-year out of the fund set aside for that purpose and having been purchased at a discount the profit on the transaction has been transferred to the reserve fund. From this fund has been written off the sum of £471 loss on sale of investments. The company is securing its fair share of orders, but the excessive competition still existing renders most of these unprofitable. The directors have been able to effect material economies and in the meantime the company's business and works are being well maintained. By recent changes in the staff, a substantial reduction will be effected in future accounts as regards the salaries list. The re-arrangement proposed below will also make a further reduction in outgoings. Mr. Peache wishes to resign his position in the active management of the business, but at the unanimous request of the board is willing to accept the position of chairman. It is proposed that he be released from the obligations provided for in his agreement with the company and that he relinquish the remuneration attaching thereto. As chairman, he will take no part in the executive work of the business, but will supervise the accounts, and his advice and experience will continue to be at the disposal of the board. It is proposed that Mr. Peache's remuneration be fixed at the rate of £600 per annum. The directors recommend that Mr. Davenport be entrusted with the general control of the business as managing director at his present rate of remuneration. Since his appointment a year ago he has shared the management of the business with Mr. Peache and has been active in increasing the efficiency of its operations and in effecting economies. In accordance with the articles of association Mr. Robertson retires from the board but is eligible and offers himself for re-election, and both he and Mr. Anderson, in view of the present position of the company, offer to reduce the rate of their remuneration from £400 to £300 per annum. On the adoption of the report these changes will come into operation as from the date of the general meeting (April 11th).

Lancashire Electric Power Co.

According to a report in the *Bury Guardian* the annual meeting of this company and its affiliated Lancashire Power Construction Co. was held in London on March 23rd, Dr. H. F. Parshall presiding.

The Chairman said that the accounts for the year 1910 showed as a result of the year's working a gross profit of £6,500, as against £130 for the previous year. This profit had been arrived at after a heavy expenditure on plant renewals and incidental charges. The general result might be summed up by saying there had been an increase of 50 per cent. in output, and an increase of 63 per cent. in revenue. This increase in the revenue account was due to the readjustment of certain old contracts, to somewhat better prices in new contracts, and to improved methods of working at the power station. He had recently been over the district and met many of the company's consumers. He found that generally there was a great change in favour of the company and of electrical working. The prospects for the coming year were distinctly encouraging, as contracts to the extent of 2,680 H.P. had been entered into, compared with 1,810 H.P. for a year ago, and negotiations were proceeding respecting a further supply of 1,700 H.P., compared with 770 H.P. a year ago. In the last annual report it was stated that the prospective profit for 1910 would very likely exceed £5,000, and that figure had been exceeded. For the current year it was anticipated that the gross profits would exceed £12,000. The maximum high-tension load on the station had increased by only 870 KW., whereas the connected load had increased by 1,760 KW. The revenue depended on the connected load, whereas the capital expenditure depended on the maximum demand on the power station, which would indicate that the business had greatly improved. Improvements had been made in the power station, so that the plant was now capable of giving from 1,200 to 1,500 KW. greater output than that indicated in the original commercial rating. For some time past it had been obvious from the rate of growth, that the company would not be able for long to meet this increase of business without augmenting the capacity of the power house. Arrangements had, therefore, been made to install another generating unit, which would increase the capacity of the plant from 40 per cent. to 50 per cent. To install this unit it had been found necessary to add to the present buildings. When the extension, as a whole, was completed, the capacity of the plant would be increased by 7,500 KW. The cost of the plant and buildings, as now authorised, was approximately £42,000. In addition to this, it was estimated that £22,000 would be required for extending mains and services and developing the business generally, making a total of £64,000. To meet these requirements arrangements had been practically completed for the issue of £150,000 prior lien bonds. This was sufficient to meet the capital requirements of the company for some considerable time to come; in fact, was more than sufficient to provide the 10,000 KW. additional plant that could be housed in the present extension of buildings. It had been practically arranged that £50,000 of this issue would be subscribed forthwith, which would more than meet requirements during the present year, including the extensions now in hand. He was pleased to say that relations with the consumers continued to be entirely satisfactory, and their relations with the different local authorities were in general harmonious. Without exception, their position in this respect was becoming stronger as time went on. The directors recognised the friendly relationship existing with the members of the staff, and considered it was largely due to their hearty co-operation and personal energy that the present substantial progress has been made.

The report was adopted.

Clyde Valley Electrical Power Co.

The half-yearly meeting was held at 53, Bothwell Street, Glasgow, on March 29th, Mr. Mackenzie, in the absence of the chairman, Mr. A. Bonar Law, M.P., presiding. We are informed that the chairman, in moving the adoption of the report, stated that the board were pleased to be in the position of submitting such a satisfactory balance sheet. The year 1910 shows a profit of £24,368, as against £10,760 for the previous year. With the continued expansion in the company's business, it has been found necessary to order another 5,000-KW. turbo-generator for Motherwell power station, this set to be ready for commission by September next. The plant capacity of the company's power houses, at Motherwell and Yoker, will then be 22,600 KW., and with over 100 miles of cable the company will be in a position to supply over a wide area. The chairman pointed out that the company continues to meet with a steadily increasing measure of support, and there is hardly an industry in the West of Scotland in which its supply is not used. The company was undoubtedly affording a public benefit to the surrounding district. Power was taken from them on a large scale, not only by the steel, iron, shipbuilding and coal trades, but by the smaller industries of all descriptions. The advantage and economy in the use of electricity supplied from central power stations were being more widely recognised. He felt sure that its adoption would be of great benefit to many undertakings, and he looked forward to a greater degree of usefulness to the district, and, incidentally, to the company.

Hastings and District Electric Tramways Co.

The directors' report states that the accounts for the year to December 31st, after including £643 brought forward, and deducting £10,832 for debenture and bond interest, show an available balance of £9,848. The directors propose to transfer £8,000 to depreciation account, making £20,000, and to carry forward £1,848. At the general meeting, resolutions will be submitted to reduce the capital from £500,000 to £372,942, by cancelling paid-up capital which has been lost or is unrepresented by available assets to the extent of £4 10s. per share on each of the issued ordinary shares, and that as from the date on which the reduction of capital shall take effect the shares shall be sub-divided as follows:—namely, each of the issued 40,000 preference £5 shares into two preference £1 shares and six ordinary 10s. shares, each of the unissued 10,000 preference £5 shares into five £1 shares, and each of the unissued 21,765 £5 ordinary shares into 10 10s. shares.

Mr. E. C. Morgan (chairman) presided at 1, Queen Victoria Street, E.C., on Tuesday over the ordinary general meeting of the above company.

The Chairman, in moving the adoption of the report, said if the shareholders examined the revenue account they would see the power expenses showed a decrease of £633, fuel being mainly responsible for this, due to mechanical stokers. Traffic expenses showed a decrease of £470, due to further economies in working and decreased mileage. Turning now to maintenance and repairs, they would observe that this showed an increase of £827, which was due to the increased cost of upkeep of the track and roadway, equipment of line and cars. In regard to the track and roadway, the bad weather had had its effect in adding to the ordinary wear and tear necessarily experienced, but the work of laying tar macadam in place of the ordinary macadam had been, and would be, continuously proceeded with, which would help to keep down the cost of maintenance for the future. They had also entered into an agreement with the Corporation for the maintenance by them of the macadam margins, which could better be done by them in connection with their own road repairs. General expenses showed a reduction of £48, the result being, after allowing for London expenditure, a net decrease of £242. The traffic receipts showed an increase of £456, the available balance after debiting fixed charges and adding the amount brought forward being £9,848, which the

directors proposed to deal with by transferring £8,000 to depreciation account, bringing up that account to £20,000, and carrying the balance of £1,848 forward. The weather conditions throughout the year had been very unfavourable for tramway traffic, more particularly by reason of bad weather being experienced during August, when their largest receipts were taken, and generally during week ends, when visitors helped to swell the total. They were able to carry 84,437 more passengers, whilst running 16,768 less miles, the traffic receipts and total expenses being higher and lower per car-mile respectively.

Mr. J. C. Williamson seconded the motion.

Mr. Henriques asked if the board saw their way to approaching the Corporation with regard to the raising of the fares so as to increase the profits.

The Chairman said they had not ceased their endeavours to attain the desirable object of reducing expenses and increasing receipts. Last year they applied to the Corporation for sanction to increase the fares on certain lines, but they only granted concessions to a very trifling extent. They could not see their way to do more at present.

The report was then adopted.

The Chairman said that in spite of the strenuous efforts of the directors, the increase in receipts, together with the savings which it had been found possible to effect, only amounted to £700, a sum so small that it had confirmed the directors as to the necessity indicated in the last report for reorganising the capital of the company. At the present time the facts showed that the capital had burdens placed upon it which it was unable to support, and in order to maintain the stability of the company upon a sound basis, it would be found necessary to reduce so much of the capital as was not at the present time represented by available assets. With this object in view, the directors had formulated a scheme. It had been found extremely difficult to preserve the equities as between the preference and ordinary shareholders; but the directors believed that a careful consideration of the explanatory letter which had been sent out, would convince shareholders that all interests had been as far as possible conserved by the proposed readjustment of capital. As was stated in the letter to the shareholders, the working of the past three years had shown conclusively the impossibility of paying the interest on the £200,000 6 per cent. cumulative preference shares, whilst at the same time making adequate provision for depreciation. The arrears of interest were also mounting up, making the chance of a dividend on the ordinary shares very remote. The directors therefore endeavoured to fix upon a sum which, after providing for the necessary changes and depreciation, could be counted upon as available for dividend, and this they put at about £5,000 per annum, and the preference interest in the scheme proposed had accordingly been made cumulative to that extent. He concluded by moving:—

(1) That the capital of the company be reduced from £500,000, divided into 50,000 preference shares of £5 each and 50,000 ordinary shares of £5 each, to £372,942 10s., divided into 50,000 preference shares of £5 each and 28,235 issued ordinary shares of 10s. each, and 21,765 unissued ordinary shares of £5 each, and that such reduction be effected by cancelling paid-up capital which has been lost or is unrepresented by available assets to the extent of £4 10s. per share on each of the issued ordinary shares.

There were also a number of resolutions dealing with the subdivision of the shares.

Mr. G. Kitchen seconded the motion.

Mr. E. S. Elliott criticised the proposals of the directors, and said they were taking away three-fifths of the preference shareholders' rights so as to give a little hope to the ordinary shareholders.

Mr. Henriques asked the chairman to explain what the capital of the company would be if the scheme went through.

The Secretary said if the scheme went through the issued and paid-up capital would consist of £80,000 £1 preference shares and 268,235 ordinary shares of 10s. each, or a total capital of £214,117 10s., against the present £341,175. The difference of £127,000 would be written off the lost assets.

Mr. G. Kitchen said the impression seemed to have got abroad that the ordinary shares were all paper, but that was absolutely incorrect. The preference shares and debentures were underwritten, and the commission was paid in shares instead of cash. Therefore, the holders of the ordinary shares at the inception of the company were the people who put their money into it in the shape of preference shares and debentures. It was not a very profitable undertaking for the underwriters, and he himself still held all the shares he had for underwriting. Then the concession was paid for partly in cash and partly in shares, and further, a great part of the commission payable to the engineers was paid for in ordinary shares; so it would be seen that the holders of the ordinary shares were not people for whom no consideration should be held. The immediate effect of the publication of the scheme was to double the value of the preference shares on the market. They must not forget that there might be possibilities in the future, for the Corporation had rights of purchase, and it was important that the value of the property, as shown in the market prices, should be considerably in advance of what it stood at to-day. They might also be asked by the Corporation to enlarge their service in some directions, and how could they raise capital in the present depressed state of their securities?

Mr. Elliott said the board were striking off 18 per cent. of the debt due to the preference shareholders.

Mr. G. T. Moody said the ordinary shareholders gave up 90 per cent. of their capital, whereas the preference shareholders were giving up very little.

Mr. Boot supported the scheme, and said technical experts well knew that the concern was over-capitalised.

The motion was carried by 22 votes to 1, and it was also agreed to at a subsequent meeting of preference shareholders.

Folkestone Electricity Supply Co., Ltd.

The annual meeting was held on March 31st. Alderman Spurgen, in moving the adoption of the report (see Electrical Review, page 526), said the company had had a most successfu year. They had increased the capital account by just over £3,000, and there was an increase on the gross receipts of £2,211—a larger increase than had been made since 1903 and 1904, when they recorded £2,000 and £3,000 respectively, but that was mainly due to several large hotels adopting electric lighting. The increased cost of working was £855, in part due to the larger quantity of coal used and in part to the extra cost of coal. The cooling tower required repairing, and they had provided £200 towards the cost which that would involve in the coming year. They had also provided £50 for minor repairs of premises. The amount available for dividend was £8,949—£1,358 more than in the previous year. The average increase in the past three years had been £800. They proposed to carry £5,000 to depreciation fund, the amount so allocated last year having been £4,300. In the early years of the company they perhaps did not make sufficient allowance for this, and they were now making up for it. The fund now amounted to £19,000. The directors proposed to pay a dividend of 8 per cent. for the half-year, making 6 per cent. for the year, as compared with 5½ per cent. in the previous year. They had taken over a small private electricity supply business, on which £216 was owing, to be paid in two annual instalments.

Alderman Penfold seconded the motion, and it was carried.

The Chairman said there was £2,175 of unallotted 4½ per cent. debenture stock, but as they had received an application for £3,000 worth of that stock, it was now all out.

Edwards Air Pump Syndicate, Ltd.

The directors' report for the year ended December 31st, 1910, states that the activity which was expected in all branches of engineering during 1910, unfortunately was not fully realised. In the course of the year Labour troubles were frequent. As the business of the syndicate is directly affected by the condition of the shipbuilding and allied industries and as most of its marine pumps come from the Clyde district, fewer pumps have naturally been booked during the past year. In spite of these adverse circumstances the directors are pleased to be able to recommend a final dividend of 10 per cent. per annum, making a total dividend of 15 per cent. for the year. The number of pumps booked during 1910 was 525, compared with 555 during 1909. Of this number 268, or 51 per cent., were for marine work, 257, or 49 per cent., were for land installations, and of the total pumps booked 119, or 22·5 per cent., were from licensees abroad. The expiry of some of the patents has naturally affected the income derived from royalties, and it is anticipated that the revenue from this source will show a considerable further decline by the end of the present year. So long as a fair revenue is obtainable it would be a mistake to liquidate the company, but the directors are considering the possibility of returning a portion of the capital to the shareholders. A list of Governments, Corporations, and companies ordering the pumps during the year is given in the report. The gross revenue for the year has been £5,088, the working expenses have amounted to £2,143, leaving a gross profit of £2,945; the balance from 1909, after paying the final dividend, is £943, making £3,888; out of this sum an interim dividend of 5 per cent., free of income-tax, was paid in June, absorbing £1,068; the directors propose a further dividend of 10 per cent., free of income-tax, making with the interim dividend paid in June last, 15 per cent. for the year, absorbing £2,136, and leaving to be carried forward £684.

Mexican Light and Power Co.—The directors have declared a dividend of 3½ per cent. on the preference shares, and a dividend of 1 per cent. on the ordinary shares.

Stock Exchange Notices.—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Montreal Water and Power Co.—Further issue of £20,000 4½ per cent. first mortgage prior lien gold bonds of £100 each, Nos. 4,618 to 4,817.

Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Calgary Power Co., Ltd.—Further issue of £72,100 30-year first mortgage bonds of £100 each, Nos. A 2,569 to 3,289.

Manila Electric Railroad and Lighting Corporation.—$5,000,000 capital stock in shares of $100 each.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—The directors have declared a dividend of 1¼ per cent. on the issued capital stock of the company, payable May 1st.

South Staffordshire Tramways Co., Ltd.—The directors have declared a dividend of 2½ per cent. (5s. per share) on the preference shares for the year ended December 31st.

Great Northern Telegraph Co., Ltd., of Denmark.—Mainly due to increased traffic receipts, the directors propose the distribution of the same dividend and bonus for 1910 as for the preceding year—viz., 18 per cent., including the 5 per cent. already paid, and to transfer to the reserve fund the usual amount, £55,556; whilst, owing to the staff being constantly augmented, it is proposed to increase the amount set aside to the pension fund by one-third, to £11,111. This will allow a somewhat larger amount than usual to be carried over to the year 1911, which is necessary in order to mitigate the effects of the unavoidable decrease of revenue during the current year, resulting from the transfer to the respective Governments of the company's cables between Great Britain and Norway, between Denmark and Norway, and between Japan and Korea.

Windermere and District Electricity Supply Co., Ltd.

The directors' report for the year ended December 31st, 1910, states that Mr. Robert Logan has joined the board. The gross revenue for the year shows a decrease of £151, which is more than accounted for by a falling off of £167 in the receipts from sale of current, owing to the further increase in the use of metallic-filament lamps. The diminution of revenue from this cause, however, appears to be about at an end, and, as a considerable number of new customers have been secured, it seems reasonable to expect that some increase of revenue may be looked for in the future. A payment of 2½ per cent. on account of arrears of interest has been received on the Keswick Electric Co.'s debentures, and from this source £47 has been credited to the net revenue account, and the amount shown in the balance-sheet due from the Keswick Electric Co. for arrears of interest has been reduced by £189. Notwithstanding the almost general adoption of metallic-filament lamps, the revenue of the Keswick Co. has been maintained at about the same level as in the previous year, owing to the fact that a fair number of new consumers have been obtained, and are now being supplied. The amount spent on capital account during the year has been £214, this expenditure being entirely for new mains, transformers and meters. The expenditure on revenue account for the year has been £1,947, being a decrease of £288 as compared with the previous year, when the cost of the new turbine was included. The balance of revenue account for the year is £1,444, plus interest on Keswick debentures (£47), and balance brought forward (£12), making £1,503. Out of this has been paid debenture interest, bankers' charges, &c., £792; interim dividend of 1 per cent. on preference shares, £250; leaving a balance of £460, £200 of which has been transferred to depreciation reserve account, leaving for disposal £260. The directors recommend that a further dividend of 1 per cent., making 2 per cent. for the year, be paid on the preference shares, which will absorb £250, and leave £10 to be carried forward. The directors regret that the addition to the depreciation reserve account should be so small this year, and are strongly of opinion that whenever practicable larger amounts should be put to the credit of this fund before any increase in the preference dividend can be contemplated.

British Aluminium Co., Ltd.

Mr. A. W. Tait (chairman) presided on Thursday last week at Winchester House, E.C., over the first annual meeting of the above company.

In moving the adoption of the report, he said the accounts which were presented were the first accounts of the reorganised company. For the purpose of convenience the trading operations for a period of a year were shown, but the proportion of profits applicable for the period from January 1st to April 11th, 1910, being the period prior to the incorporation of the company, were not available to be dealt with by that company. The result of the operations for the year showed a profit, including interest and dividends on investments, &c., of £125,064, and £90,457 of this was applicable to the new company. To this £1,408 interest on deposits and transfer fees had to be added, making a total of £91,865, which had been dealt with as follows:—Interest on loans, depreciation of furniture, and provision for income-tax, legal expenses and bad and doubtful debts, £16,360; prior lien debenture interest, £21,196; directors' fees, £2,753; debenture stock service fund, £21,612; reserve for depreciation, £25,000; and balance carried to reserve account, £4,944. Having dealt in detail with the allocation of shares in the new company amongst the old shareholders, the chairman said that under the scheme agreed to in February, 1910, the total amount of new money found for the company amounted to £998,435, the whole of which had been paid up. Under the scheme, as a consequence of the reduction of capital, there was available a sum of approximately £485,000, which was applied in reduction of the book value of the assets as at December 31st, 1909. It enabled the directors of the new company to clear out from the balance-sheet various items which did not represent tangible assets, and also enabled certain proper writing down in the value of other assets to be made, which placed this company in a much healthier position. Such items as goodwill, £92,171; expenses of the issue of the share capital and debenture stock of the old company, £51,214; and discount on issue of debenture stock, £23,312; were written off entirely. Certain sums which had been charged up as interest during construction on the Loch Leven Water and Electric Power Co. were also written off, and various amounts were deducted from other assets to make reasonable provision for contingencies. The reduction of capital also enabled the directors to write off the whole of the expenses consequent upon the receivership and liquidation of the old company, the formation of the existing company, and the heavy expense and stamp duties incurred in connection with the transfer of its assets; it also provided for the expenses and discount on the issue of the prior lien debentures. The new company, therefore, started with a clean balance-sheet, having no items which did not represent tangible assets, and the assets stood at a fair and reasonable figure. On the assets side of the balance-sheet the first item was property, buildings, engineering works, plant and machinery at date of incorporation, £1,565,604, and additions to date, £107,892; a total of £1,673,496. The property and works included under this head were:—The whole of the property, buildings, works and plant at Kinlochleven, including the village which represented an expenditure at that date of approximately £1,122,380; the Foyers estate and the works and plant at Foyers and village; the works, plant and machinery at Larne, Ireland; the buildings, plant and machinery at the rolling mills in Staffordshire; and the buildings, plant and machinery at Greenock. The additions during the year, amounting to £107,892 represented expenditure in connection with the installing of further plant and machinery at the works at Kinlochleven, and the adding of cottages and new barracks to the village, and at the works at Larne and Milton. Certain further alterations were going on, which would be completed in the course of the current year, but they were not of any magnitude, and were a part of the programme for bringing the works up to their full complement. Additions had also been made to the Alumina Works at Larne, Ireland, to enable these works to manufacture the whole of the alumina required by the company when all its existing reduction works were running up to their full capacity. Owing to the increased demand for manufactured material, it had also been necessary to install further plant at the rolling mills at Milton, Staffordshire. The whole of the programme of capital expenditure which had been embarked upon was foreseen at the time the company was reorganised, and the board had kept, and were keeping, a very watchful eye on this question of expenditure, and he was sure the shareholders would agree that it was absolutely necessary that the company should be in the position, as and when the opportunity occurred, to run the whole of its works up to their maximum capacity. Previously the expenditure at Kinlochleven was separately stated in the balance-sheet of the old company. This was necessary, because at that time the assets were under the control of a separate company, organised under a special Act of Parliament, called the Loch Leven Water and Electric Power Co. The special Act contained obligations with regard to the publishing of the accounts and other matters which the board felt were not consistent with that of a trading concern. Steps were, therefore, taken to transfer the whole of the rights and property to the British Aluminium Co., and the special Act for this purpose obtained the Royal Assent on November 28th last. It was necessary, however, to preserve the statutory rights with regard to electric light supply and for the regulation of the pier and wharves, and, therefore, two small companies were formed to look after these matters, and to administer these powers. The whole of the assets of these companies belonged, of course, to this company. The second item on the balance-sheet was investments—£527,167. These investments included the whole of the share capital of the Martigny-Orsieres Railway and the loans made to that company; the capital of the Orsieres Power Co.; the shares and debentures held in the Union des Bauxites; the shares and loan of the Stangfjord Co., which was the holder of the Reduction Works in Norway; the share capital and loans of the Loch Leven Pier Co. and the Loch Leven Electricity Supply Co., and one or two other small investments of the company. With regard to these investments, there were only three calling for special comment. The Martigny-Orsieres Railway was built for the purpose of connecting the town of Orsieres with the Swiss Federal Railways at Martigny and the Rhone Valley. It was intended that this railway should be the means of supply to the works which it was intended to erect at Orsieres, but, as these works have not yet been completed, the railway was entirely dependent upon local passenger and goods traffic. The line was completed and opened on September 1st, 1910, and they had, therefore, only had an experience of a few months of working, and that during the worst period of the year. It was impossible to say anything with regard to the results until they had had considerably more experience of the line; but he did not think they could look to receiving any return on the capital expended in the railway until some development took place at Orsieres. With regard to the Orsieres power scheme, approximately seven miles of tunnels had been cut in two sides of the mountain, and the intake works on both sides were practically completed. Nothing had yet been done with regard to the completion of the power scheme, although the plans had all been made, and the necessary land acquired for the power station and factory site. Arrangements had also been made with the Communes and with the engineers and contractors, under which the company's rights were maintained and the existing works were properly supervised until December 31st, 1912. This would give the directors time to fully consider what should be done with regard to the company's investment there, and he believed that, should it be necessary to obtain further extension of time from the communes, this would be granted, and arrangements could also be made with the engineers and contractors. The third matter was that of the Union des Bauxites Co. The company hold the greater part of the debentures and shares of this company which mines bauxite from properties situated in the south of France. Under arrangements which had recently been made, a large and valuable property had been acquired by the Union des Bauxite Co., which would ensure a very considerable amount of the finest bauxite being available for the company's requirements for many years to come; and, in consequence of this, it would be necessary for the company to advance further sums to the Union des Bauxites Co. to complete the purchase and development of this property. These advances would, however, be secured by the issue of further debentures of the Union des Bauxites Co., and the whole policy of that company was controlled by the directors of this company. With regard to stocks of metal, raw materials and stores, £86,939, the inventories had been carefully taken by the managers of the respective works and the stocks were entered in the accounts at figures which represented their prime cost only. Sundry debtors, less reserve—£58,854, represented the ordinary book debts of the company, and provision had been made for any possible doubtful debts. Turning to the liabilities side of the balance-sheet, the share capital issued represented the amounts authorised under the scheme of reconstruction. The prior lien debentures, with interest accrued, stood at £819,960. The accrued interest was paid on January 1st, 1911. The debenture stock of

£720,398 had been reduced by the amount of £3,128, being amounts redeemed during the period to January 31st, 1910. The interest accrued to that date amounted to £14,133, bringing up the total to £731,403. Sundry creditors—£41,597, represented approximately one month's credit on open account with manufacturers and others, and the usual adjustments in connection with the closing of accounts. Debenture stock service fund account—£4,202, was the amount still to be applied out of the profits to December 31st, 1910, in the purchase of debenture stock. Depreciation reserve account—£25,000, was the amount set aside out of profits to represent the depreciation applicable to the period from the incorporation of the company to December 31st, 1910. The reserve account balance of £32,731 was made up in the following manner: Proportion of profits prior to the incorporation of the company not available for distribution, £34,607; less interest on loans applicable to that period, £6,819—£27,787; amount added out of profits for period to December 31st, 1910, £4,944—total, £32,731. It was the intention of the directors to invest the reserve fund in securities outside the company's business. As to the operations during the year under review, although the output was greater than in any previous year, the company's works were not operated to their full capacity. The outlook for the industry was, however, encouraging. The demand and uses for the metal were increasing all the time, and, although this was not reflected in the price which had been received, or which might be received for some little time to come, there was undoubtedly a steady and growing increase in the demand. This would gradually take up the increased productive capacity which the various works had at their disposal, and would gradually tend towards a better level of prices. It must not be expected that there would be any sensational rise in the price, as occurred under the *régime* of the old company, but when the substantial output of which the company was capable was taken into consideration, it did not require any great increase in price to represent a substantial improvement in profits. He did not think it would be advisable to state the average price obtained for the company's metal during the year under review, but he need only say that it was low. They must not, however, take it from this that there would be any improvement in that price during the current year, but he believed that the improvement would come without the aid of any pool or combination. He may say, in this connection, that the relations between the various large aluminium producers were of a friendly nature, and, during the course of last year, meetings were held on two or three occasions at which representatives of all the large companies attended, to see whether it was possible to come to any arrangement which would be to their joint interest. After considerable discussion, however, the meetings broke up without any definite result having been obtained. He mentioned this only with a view of showing the friendly relations which existed between the various companies, and not with the idea of suggesting that there was any probability of a combination being formed. The outlook for the current year was sufficiently encouraging to lead the directors to believe that the output and sales would show improvement on those of the year under review; but it was impossible at this early stage to say what that improvement might be. There might be no improvement in the price, but there would be improvement in the demand. He stated in the circular which accompanied the scheme of reorganisation that, as the demand for the metal increased, the price and output which could be marketed by the company should place it in the position to pay regular dividends on its shares. That statement still held good, although it had not yet been accomplished. It was a very natural desire on the part of the shareholders to see a good return on their investment, but he thought that they would agree with the policy of the board, which was, that the company should be strengthened in every possible manner, so that it might be able to stand any wave of depression or competition which might arise in the industry. He considered that the results which had been achieved in the short period were reasonably good, when all the difficulties which had had to be contended with were taken into account, and, in his opinion, the success in no small measure was due to the general manager, Mr. W. Murray Morrison, and to the managers of the various works and factories of the company, and also to the whole of the staff.

Mr. S. H. Pollen seconded the motion.

Mr. Ridsdale asked whether the £485,000 was written off the first item on the assets side of the balance-sheet, or whether the item of £1,565,600 was the result of a valuation. He endorsed the policy of the board in building up the company.

Mr. Spencer asked if independent valuers had valued the stock.

The Chairman said the £485,000 was applied in writing down the assets of the old company as a whole, and that £1,560,000 represented actual money expended by the company after making allowance for all the depreciation written off by the old company, with further reductions in regard to the items to which he had referred in his speech. As to the stock, inventories were taken by the managers and the prices were checked by the auditors.

The report was adopted, and the auditors re-elected.

Metropolitan Electric Tramways, Ltd.

The directors' report for the year ended December 31st, 1910, shows a total revenue of £435,080, including £26,250 the amount of the dividend and bonus receivable upon the company's investment in the North Metropolitan Electric Power Supply Co., and £5,888 the balance of the dividend received in 1906 from the North Metropolitan Tramways Co. The traffic receipts amounted to £393,869, showing an increase over the previous year of £67,428. Working expenses and rents payable to local authorities have increased by £44,329 and £17,899 respectively. After deducting all expenses chargeable to revenue, including an addition of £21,910 to the reserve for future reconstruction and renewals, and writing down preliminary expenses by £3,000, there is a surplus of £53,767, making, with £3,578, the balance brought forward from the previous account, a total of £57,345. The directors recommend that there be placed to reserve account £8,000, dividend on the preference shares for the year (already paid) £25,000, dividend on the ordinary shares at the rate of 5½ per cent. for the year £21,523, carrying forward £2,822. The directors propose to pay an interim dividend on the ordinary shares in October of each year. At December 31st, 1910, the issued share and debenture capital of the company was:—£579,438 in 4½ per cent. debenture stock; £250,000 in 5 per cent. debenture stock; £500,000 in 5 per cent. cumulative preference shares of £1 each, fully paid; £391,337 in ordinary shares of £1 each, fully paid; £314,016 in deferred shares of £1 each, fully paid. The directors propose to issue 8,663 additional ordinary shares so as to bring the paid-up ordinary share capital to £400,000. As this number is too small for a public issue by prospectus, the directors are prepared to receive applications from the shareholders for these shares at par. Applications should be made in writing to the secretary on or before April 25th. In the event of the shares being over-applied for, the allotments will be made *pro rata*. The shares will be payable in full on allotment and will rank for dividend from January 1st last. £9,745 4½ per cent. debenture stock was bought and cancelled last year under the operation of the sinking fund. The stock was purchased at a discount, and the profit has been carried direct to the balance-sheet in reduction of preliminary expenses.

Three further extensions of the company's system have been opened for traffic during the course of the year, bringing the total length in operation at December 31st last to approximately 55½ miles. The opening of some of the extensions more remote from London has tended to reduce the average rate of earnings per car-mile, but the directors believe that the traffic receipts as a whole will continue to show steady improvement from year to year. Of the new lines opened during the past year, the most important is the extension of the Harrow Road and Paddington Tramway authorised by the company's Act of 1908. This new tramway terminates at the junction of Harrow Road with Edgware Road, opposite the terminus of the Baker Street and Waterloo Electric Railway and close to the Edgware Road and Paddington Stations of the Metropolitan and Great Western Railway Companies respectively. Under the agreements with the London County Council, referred to in previous reports, this tramway has been purchased by the Council, but is worked by the company, the Council reserving the right of joint user. In August last the London County Council gave the company notice of their intention to purchase the company's tramway situated between Finsbury Park and Manor House. The line is only ½ mile in length, but forms an important connection between the termini of two of the London electric (tube) railways and the northern and eastern portions of the company's system. Negotiations are proceeding with the County Council as to the purchase price and for the continuance of the company's user of the tramway after the purchase is effected. By the opening in February of this year of a short light railway between Enfield and Ponder's End (1½ miles in length) the whole of the original scheme of light railways promoted by the Middlesex County Council has been completed.

The directors intend to continue their policy of setting aside each year a substantial sum to meet the expenditure which will have to be incurred in future years on the renewal of the tramways and light railways. As will be seen from the balance-sheet, £83,358 has already been accumulated for this purpose, and, by agreement with the Middlesex County Council, a large portion of this sum has been earmarked for the renewal of the track, and is invested outside the business. A further amount is in course of being similarly invested.

Experiments have been made at the company's Hendon depôt with the railless traction system, which is in operation in many towns abroad. The directors are of opinion that such a system may be employed with advantage as occasion arises in opening up extensions of the existing lines in more sparsely populated districts.

The company is promoting a Bill in the present session of Parliament to sanction (*inter alia*) the construction of a new bridge over the River Lea to connect the existing light railways of the Walthamstow Urban District Council with the lines authorised by the company's Tottenham Walthamstow Light Railways Order, 1906. The Bill also authorises the construction of several short tramways linking up portions of the lines now in operation, and confers permissive powers on the Middlesex County Council and the company to buy and sell respectively the powers conferred by the above-mentioned Order of 1906. The Bill has already been approved by the shareholders.

The revenue of the North Metropolitan Electric Power Supply Co., in which the company holds 30,000 fully paid ordinary shares of £10 each and 10,000 shares of the same class, £5 paid, continues to show a satisfactory expansion. The directors of that company have declared a 6 per cent. dividend upon the ordinary shares for the year 1910, together with a bonus at the rate of 3s. per fully paid share. The total number of units sold during 1910 was 21,422,954, an increase of over 30 per cent. on the preceding year's figure. A supply of electrical energy was commenced last year under the Kingsbury Lighting Order, 1905. Mains are now being laid in the Southgate Urban District with a view to a supply of electricity being given under the lighting order which has been acquired by transfer from the District Council. The North Metropolitan Electrical Power Distribution Co., Ltd., shows improved results from its four undertakings at Barnet, Enfield, Hertford and St. Albans, and for the past year has paid a dividend of 4 per cent. upon its ordinary share capital.

	1910.	1909.
Mileage open (at Dec. 31st)	55·375	51·50
Number of passengers carried	76,460,980	62,357,947
Number of car-miles run	8,761,837	7,033,186
Average receipts per car-mile	10·78d.	11·18d.
,, ,, ,, passenger	1·23d.	1·25d.
Number of cars in stock (at Dec. 31st) ..	262	237

Mexico Tramways Co.—The directors have declared a dividend of 1¾ per cent. for the quarter ending March 31st, on the issued capital stock, payable in Toronto on May 1st.

Continental.—Russia.—The Gesellschaft für Electrische Beleuchtung, of St. Petersburg, is declaring a dividend of 7 per cent. for the last financial year.

County of Durham Electrical Power Distribution Co.

The meeting of this company was held on March 29th at the Central Station Hotel, Newcastle, Dr. J. T. Merz in the chair.

The Chairman said he had to report that the horse-power was now 39,070, which was an increase of 4,046 for the year, and one that was less than reported last year, when it was 5,688. The profit, however, in spite of the increased number of customers connected, was less by £2,295, and this had resulted in the necessity of reducing the preference dividend from the full amount of 5 per cent. to 3¾ per cent. The reason why this reduction had taken place, in spite of the increased business by the connecting up of new customers, was that during the early part of the year the coal trade was in a state of unsettlement, and that company was more affected by this class of consumer than was the Newcastle Co. Then their company suffered, also, though not perhaps to the same extent as the Newcastle Co., through the lock-out in the shipbuilding trade during the last three months of the year, which was ordinarily the best quarter from the point of view of the company's business. On the other hand, the lighting had increased. Some 136,732 more units had been sold, and the increased profit was £12,652, against £11,254. Therefore they saw that the ill-effects of the introduction of the metal-filament lamps, which affected the lighting very considerably during the last three of four years, had been got over, and that they were on the increase. The depreciation had been fixed at the same amount, viz., £6,000. The capital expenditure had been £21,079. Here he must enter into a little explanation. If they referred to the balance-sheet they would see that instead of an increase in the capital sum, there was a decrease of £26,000 on balance. This had arisen in the way explained in the report. They would there see that it was merely an exchange between the two companies, viz., the Parliamentary Co. or the Power Supply Co., and their own company, which was the Distribution Co., and which worked under provisional orders, whereas the other company worked under Act of Parliament. The relation of these two companies was this: The Distribution Co. owned the shares in the Parliamentary Co., and as the Distribution Co. was the financing company, and had to find the money that was spent by the Parliamentary Co. the Distribution Co. in return for this increased its holding in shares. The great proportion of the work which was done was not only done under the supervision of the Distribution Co., but was financed by the Distribution Co. In addition to that he had to point out that a great deal of this work could not be fixed exactly in amount, till the work was finished, and then, when the work was finished, a transfer was made in the books to the effect that so much of this work had been transferred as an asset to the Power Supply Co., and the Distribution Co. got in return an equal amount of shares. This, therefore, did not affect the balance-sheet of the two companies. Taken together the profit and loss accounts were not affected by this transfer. If they took into consideration the Power Co.'s figures in addition to the figures of the Distribution Co., then they would find that there had been sunk in plant £21,079; and as the capital, as it stood, had not been increased, they might wish to know how they got this £21,079. Well, roughly speaking, they got it out of the funds which they had in hand to the extent of £15,386, and they retained £6,000 out of the profits of the company, and these together gave them about the sum that they had spent. A company like that was not increasing its capital at present, and had not increased its capital for some years; and there were only three ways of getting money for its extension. Either they must take it out of funds, or assets, or they must get it out of a proportion of the profits it earned, or get it by loans on trade creditors for the time being. These were the only ways. For this year they got it, as he said, by drawing on their fluid funds, and by retaining £6,000 of the profits. It did not follow that this £21,079 would exactly appear in the accounts in the way he had stated, because a portion of those extensions might not at the end of the year be paid for, but they would then appear as trade credits. Regarding the future, he could not give them much information, but he could say that so far the profits of the company for the first 12 weeks had been somewhat better than last year, but they had not yet experienced that great improvement in trade of which some of their customers spoke, though there was no doubt that as they got fully to work and carried out the orders in respect of which they had so many inquiries, then their returns must be beneficially affected. He moved the adoption of the report.

Mr. John Hobart Armstrong seconded.

Major Leather said it seemed to him that the explanation of the chairman as to the want of increase in the profit was not an altogether satisfactory one. It was put down to bad trade and strikes, but looking back on the old accounts he saw that in spite of the increase in horse-power every year the profits had not increased correspondingly. It appeared to him, therefore, that the present state of things had something to do with the working costs. He should like to ask why the working costs had been left out of the profit and loss account. In 1907 they were shown. Since then they had not been shown. He understood that most electric lighting companies had been reducing their working costs, whereas in the case of their company it did not seem to be so. He should like the chairman to give a reason why the working costs had been left out of the profit and loss. It looked as if there was something to conceal from the shareholders.

The Chairman said that question was fully answered two years ago in the report of the Electric Supply Co. He had also referred to it at a meeting of that company. The reasons why they did not publish the costs were several. One reason was that if they published the costs they would be made use of by other persons, not in the interests of the shareholders. Any shareholder who asked for the information simply as a holder in the company, and not in any other interest, would be given the particulars. He might say, generally speaking, that the working costs were charged to this company under an arrangement with the Newcastle Supply Co., who were really the managers of this company, and that these costs were lower than any working costs of which he knew. The reason why the profits were not larger was that the number of customers was not in proportion to the capital which was sunk. The company had outrun in its capital expenditure the increase in the number of its customers, but it had already been explained that their system had of necessity to be first laid down. There were a great many inquiries for power, and as the customers increased so would their profit increase proportionately.

The report was adopted without further discussion.

A dividend of 3¾ per cent. on the preference shares was declared.

Mr. W. L. Madgen and Dr. J. T. Merz were re-elected directors.

Newcastle Electric Supply Co., Ltd.

The meeting of this company was held on March 29th at the Central Station Hotel, Newcastle. Dr. J. T. Merz presided over a large attendance of shareholders.

The Chairman referred to the loss which the board of directors had sustained through the death of Dr. Spence Watson, and by the retirement of Mr. T. G. Gibson. He said the connections to the system at the end of the year amounted to 139,776 H.P., which, compared with the figures of the previous year, 129,210 H.P., showed an increase of 10,657 H.P. The net profit for the year had been £107,778, an increase of £5,626 on the previous year. If they eliminated the movement in the interest, the increase had been only £2,876, so that they would see that, practically speaking, they had only just succeeded in maintaining the state of business as it was in the year before. At the beginning of the year there was the unsettlement in the coal trade. Near the end of the year the lock-out in the shipbuilding trade paralysed all trades connected with that industry, and what the company gained in the first eight months of the year was practically lost in the last four months. The increase of business was 4 per cent. for the first quarter; 17 per cent. for the second and third quarters, and in the last quarter it fell down to 8 per cent, and in the last month to a very small figure. It followed, therefore, that the profit made per horse-power was less than in the year before. The profit per horse-power during the year had fallen from 16s. to 14s. 6d. So far as electric lighting was concerned, they had, he was glad to say, got to the bottom of the deficiency which had been created through the introduction of metal-filament lamps. It had been stated on various occasions that the introduction of these lamps reduced the consumption very much, and he had to report a year ago that the reduction was 118,000 units, whereas in the year just past the reduction was only 9,359 units. While the consumption had decreased, a great many more of these lamps had been introduced, and the company had tapped an area of consumers which previously had been hardly accessible to them. Regarding the consumption of coal, there was a saving of 3·6 per cent., which was entirely due to higher efficiency of working. The capital stood the same, but there had been a considerable increase of interest on borrowed money, for the simple reason that a large portion of the borrowed capital, which was increased the year before to, he thought, £687,500, was only paid up in the last month of the year. The interest was £9,005 more than in the previous year. Of the total capital £110,000 had been sunk in the extension of the works of the system. He would like to draw their attention to a point which was of some importance. For the last four years the total capital expended on the works of the system had been £658,199, and of that sum £476,618 had been spent on generating stations, including the tunnel under the River Tyne, which he included as belonging to Carville station, and the expenditure upon connections and mains to reach consumers had been £181,581. They had connected during that period 69,776 H.P. Every horse-power cost £9 10s., and of that £6 16s. 6d. was spent upon generating stations and £2 13s. 6d. upon connections. The meaning of those figures was that during the last four years they had spent much more on each horse-power connection than they would do in the future, and instead of £9 10s. the figure would probably be about £5 per H.P. An important departure in the business of the company was in regard to the use of waste heat and gas for generating electricity. That had gone on and had been further developed last year. In 1909 they utilised waste heat at a saving of 30,000 tons of coal, and last year the saving amounted to 33,881 tons. As to the prospects for the coming year, he could not say very much. The improvement in business so far this year had been slight, and they had not reaped much benefit from the improvement of trade in that district, but they had expectations of a great improvement in the course of the year.

The adoption of the report having been seconded,

Mr. Hutton moved as an amendment to the resolution, that no dividend be paid on the ordinary shares. The money had not been earned. There were items in the accounts, he asserted, which must have struck everybody as, to say the least, misplaced. Among the assets were:—Investments at cost and loans:—Priestman Power Co., Ltd., £10,000; Tyneside Tramways and Tramroads Co., £13,000; County of Durham Electrical Power and Distribution Co., Ltd., £49,125; Durham Collieries Electric Power Co., Ltd., £23,676, and loans at short notice, £43,104. So far as he could ascertain, only one of these concerns had any quotations, and therefore he considered them as valueless. The total amount of dividend they proposed to be paid was £10,312, and he considered that if they paid that, they were paying money they had not

earned, and, therefore, they had no right to pay it. He was a considerable shareholder in the ordinary as well as in the preference shares. Mr. Hutton criticised other items in the report.

Dr. Peart, North Shields, said he would, *pro forma*, second the amendment.

A Shareholder remarked that they did not go there to be told they were to get no dividend: perhaps Mr. Hutton would give them some information on the point he had raised.

The Chairman said the investments which Mr. Hutton had criticised had been before the shareholders for many years. They had been explained, and if the shareholders wanted any further information, they must look for it in past reports. The directors could not say anything more than what had been said before.

The amendment was lost, only two shareholders voting for it, and the report was adopted.

The Chairman added that a large shareholder, who could not be present, had asked by letter the position of the debenture debt. His reply was that the debenture debt was fully secured three times over; it was secured by the assets of the company, and when the time came, 28 years hence, for the repayment, there would be ample funds to repay, or securities to raise money upon.

Mr. J. H. Armstrong and Mr. James Tennant were re-elected directors, and Mr. Frederick Stirling Newall was elected to the vacancy on the board caused by the retirement of Mr. Gibson.

Dividends at the rates of 5 per cent. for the year on the preference shares, and 4 per cent. for the year on the ordinary shares, were agreed to.

Replying to a vote of thanks, the Chairman said he hoped to give them a better report next year, but it was impossible to make any prophecy at the present time.

Wycombe (Borough) Electric Light and Power Co., Ltd.

The directors' report for the year ended December 31st, 1910, states that satisfactory progress has been made during the year, the connections having risen from 51,025 to 53,379, being an increase of 2,354 equivalent 8-c.p. lamps. The result of the year's trading, including a balance of £83 brought forward from the previous year, shows a profit to the credit of net revenue account of £5,014, and after paying interest on debentures and outstanding accounts £3,009, there remains a balance of £2,004 available for distribution. The directors recommend the payment of a dividend at the rate of 2 per cent. for the year, which will absorb £800, and that £1,200 be placed to the reserve fund for renewal account, leaving a balance of £4 to be carried forward.

Units generated		1,174,952
Units sold.		
Public lamps	130,317	
By contract	286,307	
Private consumers by meter	518,954	
		935,578
Quantity used on works	115,635	
Distribution loss	61,279	
Total quantity accounted for		1,112,492
Quantity not accounted for		62,460
Number of public lamps		12 arcs, 357 metal lamps
Total maximum supply demanded		566 kw.
Lamps connected January 1st		51,025
Lamps connected December 31st		53,379

Gateshead and District Tramways Co.

The annual meeting was held on Thursday last week at the Electrical Federation Offices, Kingsway, Mr. C. R. Greene, J.P., presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, March 24th), said that although the traffic receipts did not show any increase during the past year, the expenses had been reduced, and the net result was an improvement of £770 in the net profit. The dividends were the same as for the previous year, but the amount carried to the reserve fund was greater. After these allocations had been made, the renewals, reserve and sinking funds would amount to £42,280, equivalent to 12½ per cent. on the total capital expenditure. There was a decrease of £7 in the traffic receipts and an increase of £14 in parcels, £1 in advertising, £75 in sundries, and £159 in interest—a net increase in revenue of £242. The expenses showed a decrease of £528, made up by a decrease of £47 in power, £152 in running expenses, and £203 in repairs and maintenance. Administration expenses were down £54. Under this head a saving of £233 was shown in insurance, while the rates and taxes, over which the board had no control, were increased by £201. During the year there had been an expenditure of £14,658 on capital account, making the outlay upon the undertaking at December 31st last £333,043. That additional expenditure was foreshadowed at the last meeting, and it was made up of the cost of constructing the extensions to Bensham and Wrekenton routes and the doubling of about 1½ miles of the Low Fell route, and it also included the cost of making additional car-shed and new store buildings. It was satisfactory to remember that the whole of that expenditure had been paid out of reserve. The shareholders would remember that the extensions were undertaken in accordance with the requirements of the Gateshead Corporation, by which the company received an extended tenure of eight years for the whole of the undertaking. The lines were opened last October, and, so far, the traffic on the extensions had been small. It was hoped, however, that building developments would take place along the new routes, and that eventually satisfactory traffics would result. The directors had received a request from a number of the shareholders that interim dividends should in future be paid on the ordinary shares, and after careful consideration they had come to the conclusion that the company was sufficiently well established to pay interim dividends, and they hoped to sanction the first payment at the end of September next. A request had also been made that the £10 shares should be split up into £1 shares. That suggestion the directors must dismiss for the present as the company was a statutory company, and an alteration in the denomination of the shares would necessitate the obtaining of a special Act of Parliament. The directors would, however, bear the matter in mind when it was necessary to go to Parliament on other matters, but at the moment they did not feel that there was any real need for the alteration. The Newcastle Corporation were applying in the present session of Parliament for powers to run motor omnibuses in Gateshead and other districts, and the directors were taking the necessary steps to oppose the granting of such powers.

Mr. G. S. B. Hilton seconded the motion, and the report was adopted.

Anglo-Argentine Tramways Co., Ltd.

The directors' report for the year 1910, states that the gross receipts amounted to £2,419,185 less working expenses (which include various items amounting in the aggregate to £110,000 carried to depreciation renewals funds in addition to £274,997 expended on ordinary maintenance) £1,564,093, leaving £855,092, plus £10,348 brought forward, and £3,431 power station Paseo Colon balance of rent. From the £868,871 thus resulting are deducted the following:—Annuity to "city company," £70,660; 4 per cent. debenture stock interest, £178,627; 4½ per cent. debenture stock interest, £78,002; 5 per cent. debenture stock interest, £17,462; 5 per cent. first preference dividend, £160,000; 5 per cent. second preference dividend, £125,000; rent of Metropolitano Tramways (balance), £18,525; 4 per cent. debenture stock sinking fund, £19,728; 4½ per cent. debenture stock sinking fund, £3,123; sinking fund for redemption of the first and second preference, and ordinary share capital, £2,250 = £673,378; leaving £195,493, less interim dividend of 3½ per cent., less income-tax, on ordinary shares for half-year ending June 30th, 1910, £82,396; leaving a balance of £113,097. Out of this balance, the directors now recommend that a final dividend of 4½ per cent. be paid on the ordinary shares for the half-year ending December 31st, 1910, less income-tax, making 7¾ per cent. for the year, which will absorb £100,052, leaving £13,045 to be carried forward to 1911. An agreement has been arrived at with the board of the Buenos Ayres Western Railway, Ltd., by which that company abandons its concession to construct a subway for the conveyance of passengers from Plaza Once to Plaza Mayo. The terms agreed upon are of distinct advantage to both companies, and have been sanctioned by the National Government and the municipal authorities. Contracts have been entered into for the construction of this subway, and the work will be actively commenced in the course of the year. It is anticipated that this line will be in service early in the year 1913. £1,500,000 5 per cent. debenture stock, part of £6,000,000 authorised at the last general meeting, has been issued, the net amount realised being £1,387,500. The Metropolitano Tramways Co.'s lines, hitherto held on lease, were acquired on September 7th last by payment of £353,088 (out of the proceeds of the issue of 5 per cent. debentures). Under the terms of purchase the payment of £5,000 per annum by the vendors to the Anglo Company in respect of the Paseo Colon power station ceases. As against the capital outlay involved, revenue will be relieved of a charge of £22,000 net per annum. The first and second cumulative preference shares rank for dividend as from January 1st, 1911, at the rate of 5½ per cent. per annum. The directors regret to report the death in June last of their esteemed colleague, Mr. Herman Stern, president of the Bank of Brussels. Mr. Hector Monnom, managing director of the said bank, has been elected to fill the vacancy. The board again place on record their appreciation of the services rendered by the local committee, the general manager (Mr. Pedriali), and the staff generally, at home and abroad.

A lengthy and interesting report by the manager is attached to the directors' statement.

	1907*.	1908†.	1909‡.	1910§.
Receipts	£1,009,568	£1,262,759	£1,938,888	£2,419,186
Expenditure	654,076	790,687	1,207,222	1,564,093
No. of passengers carried	113,945,752	142,939,805	223,823,792	276,426,524
No. of miles run.. ..	16,861,707	21,850,182	35,130,039	42,881,395
Receipts per mile ..	14·37d.	13·87d.	13·25d.	13·54d.
Expenses per mile ..	8·38d.‖	8·16d.‖	7·90d.‖	8·14d.‖
No. of cars in stock ..	1,039	1,245	2,030	2,156

* Includes "Anglo" and six months "Belgrano" systems. † Includes Belgrano system for the year and Buenos Ayres Electric and Belga Argentine systems for second six months. ‡ Includes La Capital, Buenos Ayres Grand National, La Nueva and Metropolitano systems for the last nine months of the year. § Full year's working of incorporated companies. ‖ Does not include credits or debits to depreciation renewals funds.

Prospectuses.—*Mexican Northern Power Co., Ltd.*—The list was to close on Wednesday in an offer of $4,500,000 first mortgage 5 per cent. 30-year gold bonds at 90 per cent., with bonus of 50 per cent. of common stock. The company own a perpetual concession from the Government conferring the right to use the waters of the River Conchos for the development of hydro-electric power, to import the original installation free of duty, &c.; also a concession for the construction of railways in the State of Chihuahua.

Central London Railway Co.—This week an issue of £385,000 4½ per cent. preference stock has been offered and over-subscribed. The money is required for the Bank to Liverpool Street extension, which is now constructing.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	Inc.
Aberdeen	Mar. 29	2,398	— 26	43	60,024	+15,840	..	..
Ayr	April 1	364	— 126	46	18,311	+ 330	8	..
Bath	„ 1	1,306	— 513	13	8,408	— 682	..	..
Belfast	Mar. 31	7,914	— 576	52	213,909	+18,882	37	..
Birkenhead	April 2	2,099	— 110	..	..	..	13·68	..
Birmingham Corp.	Mar. 25	13,777	+ 670	51	354,487	+ 9,883	56·7	..
Blackburn ..	„ 29	1,873	— 911	..	..	..	14·6	..
Blackpool Corp. ..	„ 30	803	—1,944	..	56,341	— 1,029	..	..
Blackpool-Fleetw'd	April 1	538	- 1,192	13	8,227	— 942	..	..
Bolton	Mar. 26	4,315	— 789	52	122,040	+ 1,826	26	..
Bournemouth ..	„ 29	2,820	—1,038	51[6]	89,096	+ 3,675	21·9	..
Bradford	„ 25	9,546	— 485	51	260,444	+11,592	54·81	..
Brighton	April 2	1,544	— 547	..	..	..	9·5	..
Bristol	Mar. 31	10,553	—2,271	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 24	418	— 9	12	2,513	— 7	3·65	..
Barnsley	„ 24	352	+ 7	„	2,010	+ 27	..	..
Barrow	„ 24	405	— 34	„	2,703	+ 47	5·37	..
Cavehill	„ 24	131	— 7	„	718	+ 61	..	..
Devonport	„ 24	845	+ 60	„	4,986	+ 320	8·85	..
Gateshead	„ 24	1,962	— 11	„	11,702	+ 515	11·25	..
Gravesend	„ 24	361	— 19	„	2,079	— 78	6·5	..
Greenock	„ 24	1,221	+ 112	„	7,087	+ 1,135	7·25	..
Hartlepool	„ 24	496	— 25	„	1,318	+ 61	6·72	..
Kidderminster ..	„ 24	162	— 3	„	973	+ 20	..	..
‡Leamington	„ 24	256	— 7	„	1,516	— 118	..	..
Merthyr	„ 24	362	— 22	„	2,148	— 18	2·9	..
Metropolitan	„ 21	15,838	+ 890	„	89,657	+11,988	22	..
Middleton	„ 24	570	— 30	„	3,312	+ 231	8·5	..
Mid. Joint Com'tee	„ 24	11,227	+ 285	„	64,720	+ 2,547	..	..
Oldham—Ashton	„ 24	1,141	— 120	„	6,088	+ 72	9·13	..
Peterborough ..	„ 24	209	— 4	„	1,168	+ 46	5·31	..
Potteries	„ 24	3,787	+ 834	„	22,068	+ 2,121	29	..
Rothesay	„ 24	91	— 20	„	511	— 4	2·75	..
Southport	„ 24	451	— 60	„	2,653	+ 12	8·17	..
S. Metropolitan ..	„ 21	1,354	— 167	„	8,022	— 279	..	..
Swansea	„ 24	2,041	+ 65	„	12,183	+ 800	12·5	..
Tynemouth	„ 24	284	— 60	„	1,728	+ 55	3·75	..
Weston-s-Mare ..	„ 24	44	— 22	„	218	— 91	3	..
‡Worcester	„ 24	461	— 28	„	2,705	— 28	5·75	..
Wrexham	„ 14	178	— 21	„	1,025	+ 3	..	..
Yorks. Wool. Dist.	„ 24	1,900	+ 65	„	11,588	+ 980	17	..
Miscellaneous ..	„ 24	372	— 27	„	2,349	+ 56	..	..
Burnley	April 1	2,494	— 437	..	..	..	11·73	1
Burton-on-Trent ..	„ 2	488	— 36	52	13,990	+ 241	6·6	..
†Bury	Mar. 2	1,068	— 394	51[2]	59,820	+ 852	22·5	..
Cardiff	„ 31	3,745	+ 20	52	116,806	+ 2,499	..	..
Carlisle	..	..	..	..	..	..	..	..
Chatham and Dist.	„ 30	1,419	— 579	13	9,481	— 435	14·98	..
Cork	„ 30	898	— 24	13	5,418	— 174	9·89	..
Croydon	„ 27	3,088	— 76	..	82,764	+ 3,239	..	..
†Darlington ..	„ 25	188	+ 8	52	10,386	+ 867	..	..
†Darwen	„ 24	219	— 54	51	12,180	— 400	4·36	..
Dover	„ 25	337	— 25	51	10,986	+ 489	4·75	..
Dublin	„ 31	9,255	—1,016	..	64,077	— 424	54·25	..
Dundee	„ 29	2,184	— 198	15[2]	68,791	+ 306	15	..
East Ham	April 1	1,991	— 112	52	53,638	+ 1,884	7·87	1
Exeter	Mar. 31	536	— 98	52	16,166	— 763	5·5	..
Glasgow	April 1	35,698	— 616	..	779,939	+42,338	97·7	2
Hastings	„ 3	1,458	— 865	..	..	..	..	..
Huddersfield ..	..	..	..	..	..	..	..	..
Hull	„ 1	5,518	+ 145	52	144,225	+ 7,043	14·5	..
Ilkeston	Mar. 30	231	— 57	52	6,588	— 262	..	..
Ipswich	„ 31	606	— 112	52	21,170	+ 856	10·5	..
Kilmarnock	April 1	275	— 10	46	6,912	+ 260	4·25	..
Lancashire United	Mar. 19	2,861	— 873	..	15,207	— 653	39	..
Leeds	April 1	13,811	—1,812	52	365,675	+10,545	57	..
Leicester	..	..	..	..	..	..	..	..
Leith	„ 1	1,034	— 130	45[2]	27,071	— 17	3·72	..
Liverpool	Mar. 25	21,724	— 88	12	129,770	+ 3,621	116	6·5
‡L.C.C.	„ 22	82,517	+3,738	..	2,122,898	+217,078	136·7	5
London United ..	April 1	10,427	—3,259	..	68,817	— 3,601	..	..
Lowestoft	„ 1	276	— 35	26	4,064	+ 192	..	..
Manchester	„ 1	30,5 3	—1,458	52	804,808	+22,017	183	..
Newcastle	„ 1	7,668	— 599	..	206,130	+ 2,791	14·5	..
Newport	Mar. 31	1,124	— 46	52	35,147	+ 1,211	14·5	..
Oldham	April 2	3,645	— 325	..	..	..	23·5	·5
Pontypridd	..	..	..	..	..	..	..	..
Portsmouth	„ 1	8,3 9	— 980	52	102,785	— 2,507	15·25	..
Preston	Mar. 29	1,312	— 185	52	37,604	— 259	..	..
Rotherham	..	..	..	..	..	..	..	..
Salford	„ 27	8,822	— 60	51[2]	239,329	+ 5,565	..	..
Sheffield	April 4	11,846	+ 692	..	..	..	40	·25
Southampton ..	Mar. 29	1,950	— 186	52	56,595	+ 1,408	..	..
Southend-on-Sea ..	„ 29	774	— 351	52	28,634	+ 2,389	..	..
South Shields ..	April 1	1,088	— 187	52	28,947	— 106	..	..
Swindon	Mar. 29	248	— 41	..	7,333	+ 242	..	..
Tyneside	„ 29	770	— 447	13	4,468	— 140	..	..
Wallasey	April 1	1,866	— 81	52	49,692	+ 2,821	..	..
Walthamstow ..	„ 1	1,252	— 350	52	85,876	+ 1,811	9	..
West Ham	Mar. 28	4,820	+ 275	51	126,212	+ 6,481	15·25	..
Wolverhampton ..	„ 29	1,752	— 148	52	48,681	+ 4,209	14·25	..
Cen. London Rly...	April 1	10,672	+ 960	13	70,050	— 1,308	6·32	..
City & S. Lon. Rly.	„ 2	6,724	+ 427	13	44,853	+ 1,673	7·26	..
Dublin-Lucan Rly.	Mar. 31	207	— 108	13	1,364	— 94	7	..
G.N. and City Rly.	April 1	3,224	+ 389	13	20,706	+ 9 6	3·5	..
L'pool Overh'd Rly.	„ 2	2,798	+ 81	..	17,908	+ 1,113	6·8	4·8
†Llandudno-Col. Bay	Mar. 5	132	— 48	16[2]	2,000	— 2	..	..
London Elec. Ry. Co.	April 1	28,415	+3,040	13	184,695	+11,095	21·25	..
Mersey Railway ..	„ 1	4,140	+ 96	13	26,408	+ 661	4·5	..
Metropolitan Rly.	„ 2	33,335	+1,135	..	219,221	+ 6,168	24·5	..
Met. District Rly.	„ 1	28,785	+2,947	13	153,701	+12,755	24	..
Anglo-Argentine ..	„ 1	100,817	+13,486	..	644,104	+84,584	..	..
‡Auckland	Mar.	16,054	+1,069	..	142,628	+14,4·0	28·8	·7
Bombay (B.B.S.T.) ..	„ 8	5,721	+ 457	5	14,064	+ 657	..	..
Brisbane	Feb.	17,675	+1,925	8	36,885	+ 3,995	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	April 3	7,280	+ 506	..	..	..	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A...	Feb.	2,968	..	..	6,212	..	20·5	..
‡Lisbon	..	..	..	..	..	..	..	..
Madras	Mar. 15	1,755	+ 406	..	7,550	+ 874	..	..
§Montevideo ..	Mar	28 493	+3,102	20	140,920	+13,478	..	..
†Perth (W.A.) ..	Mar. 31	3,230	+ 51	..	21,389	— 809	29	1

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES —Tuesday Evening.

Anticipations of a fall to 2½ per cent. in the Bank Rate this week led to a stiffening of prices amongst the investment markets, in which most sections joined. The principal excitement continues to be in Home Railway Stocks, which enjoy an increasing amount of public attention, not only on behalf of the speculator at home, but also the investor here and abroad.

Underground lines are hardly as popular as the Steam stocks, and activity is very spasmodic; most of it comes in Metropolitans and Districts. Metropolitans rose last Saturday to 55⅝, while Districts touched 33. Although neither of these top prices was maintained, both stocks show substantial rises on the week. Central Londons are better, the demand running more particularly on the Deferred, which followed up its gain of 5 points last week with a further rise of 2. City and South London temporarily recovered its slight relapse, but went back to 34½. Business goes on quietly in Great Northern and City Preferred, and shares have been changing hands at about 26s. and 27s. As the market, however, is poorly supplied with shares, there is no inducement to the jobbers to draw attention to the gamble, and therefore the shares are neglected except by a few people. The new Central London 4½ per cent. Preference stock looks cheap at par, and it has been favourably received in the market, where 3 premium was bid.

One of the chief features so far this week has been East London Ordinary, the price rising to 7¼ on the idea that electrification is at hand. The junior Debentures have risen to 32, 14 and 10 for the "B," "C" and "D" issues respectively. It is now as difficult to buy stock as a few months ago it was hard to sell it. Brighton Railway Deferred is one of the most animated at the moment amongst the steam stocks, and after rising to 111½, a price not touched since 1907, it reacted to the extent of about ¾.

Electricity supply shares are exceedingly quiet, and beyond a few movements upwards in the prior charge descriptions, there is no particular change to record. A rise of 10s. in Edmundson Preference stands out as the main feature, and is an indication of the way in which the public are on the look out for neglected shares which present any possibility of improving their position. Brompton and Kensington Preference are rather easier. St. James' and Pall Mall Ordinary went up ⅛. Urban Preference shares and Debenture stock have hardened, and the latter stock is being indicated in some quarters as a cheap investment of its kind.

The Telegraph market is rather dull, interest being absorbed by a lively gamble in Oil shares, supplemented by a revival in Rubbers. Anglo-American Deferred went back ⅞, because the report of the American Telephone and Telegraph Company—a most voluminous document—makes no reference whatever to the agreement between that company and the Anglo-American. Tired bulls of Anglo "A" accordingly sold, and realisations of good profits account for a drop of 5s. in West India and Panama shares, which left the price at 2¾, the same as it was a fortnight ago. Direct United States Cables are easier, but the Eastern group keeps very firm. Globe Telegraph and Trust Preference recovered half-a-crown of the dividend deducted at the last Stock Exchange account day, while the Ordinary remained at 10½. There has been a little more doing in Marconi shares, with the result that the price was raised to 18s. 9d. A number of Telegraph Debenture stocks have improved a point or so. Telephone varieties are quiet. The only changes in the National Telephone group consist of a rise of ½ in the Deferred stock and a further fall of ⅛ in the Third Preferences. Interest in the redemption of the issues by the Government has died down for the time being, but no doubt it will be revived again some months before the extinction of the company as such.

Latin-Canadian shares and bonds are mainly better, the reported settlement of the trouble in Mexico being an influential factor. Mexican Electric Light 5 per cent. gold bonds have gained ½. Mexican Light and Power gold bonds are up to the same extent, though this company's common shares slipped back a point. The Tramways common stock rose 1, and Rio Trams are good at 112, while Sao Paulo Trams have gone up to 167. Paras have strengthened, on the splendid results being secured by the company.

The issue of Mexican Northern bonds last week was announced as having been over-subscribed, but a singular misunderstanding arose which partly accounted for it. Some of the people to whom the issue was first offered, went into it thinking that they were merely underwriting the bonds in the ordinary way. In the allotment, however, these applications were treated as though coming from the public, and so the issue may be said to have been floated by the direct aid of the underwriters. There was no harm done, because a premium of 1 per cent. for Special Settlement became quickly established, while the common stock—which is simply "water"—is quoted about 30½. But those who went into the business thinking that it was an ordinary underwriting transaction will probably make a particular point of studying agreements that they sign in the future.

Metropolitan Electric Trams Ordinary shares have again receded, the effect of the increased dividend, the good report and the stimulus afforded by the meteoric rise in London General Omnibus stock having apparently worn off, and very rapidly at that. British Electric Traction Preference put on a further ⅛, and the company's two Debenture stocks have hardened. London United Tramways shares are unchanged, but the Debenture stock fell a point.

Edison & Swan "A" shares, partly-paid, are easier, but except for this the manufacturing market remains steady. India-rubber shares are 5s. higher. The market for rubber appears to have rallied, and rubber shares had one of those sharp uptwists which so completely baffle the speculator, besides annoying the investor. Willans & Robinson issues have not sunk any further on a report which is depressing. Callender's Ordinary have risen ⅛, and Henley's Preference rose ⅛, while the Debenture stock also improved.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1907.	1908.	1909.	1910.	Closing Quotations March 28th.	Closing Quotations April 4th.	Business done week ended April 4th, 1911. Highest	Lowest.	Rise + or Fall —	Present Yield per cent £ s. d.
		*										
300,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	6⅞ — 6⅝	6½ — 6⅝	6⅝	..	..	Nil.
$263,244,000	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	96⅛ — 98½	96¼ — 98½	..	..	..	5 1 6
$255,196,000	American Telephone & Telegraph, Cap Stock ..	$100	8 %	8 %	8 %	8 %	148 —150 xd	148 —150	..	..	..	5 6 8
$68,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 8
545,920	Anglo-American Telegraph	Stock	3¾%	£3 4s.	3⅝%	3⅝%	69 — 71	69 — 71	70½	69½	..	5 5 8
3,227,040	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	113 —114	112¾—113½	113⅜	112¾	— ½	5 5 9
3,227,040	Do. do. do. Deferred	Stock	1 %	8/-	25/-	30/-	37½ — 37⅞	26⅜ — 26⅝	27 7/16	26 7/16	— ¼	5 11 1
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7 1/16 — 7 5/16	7 1/16 — 7 5/16	7 1/16	7 1/16	..	5 9 5
2,462,309	Commercial Cable, Stlng. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	86 — 88 xd	87 — 89	88	87⅞	+ 1	4 9 11
16,000	Cuba Telegraph	10	6 %	6 %	6 %	..	9¼ — 10½	9¼ — 10½	10	..	..	5 9 1
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	..	17½ — 18½	17½ — 18½	..	..	..	5 9 7
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4%	3⅜ — 4 xd	3⅜ — 4	..	..	..	5 0 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10%	8¼ — 8⅝ xd	8¼ — 8⅝	..	..	..	5 14 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
60,710‡	Direct United States Cable	10	4½%	4½%	4 %	5 %	7⅜ — 8¼	7⅞ — 8¼	8 1/16	7 13/16	— ⅛	6 8 1
32,500	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99½—101½	100 —102	..	..	+ ½	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	135 —138	135 —138	137½	135¾	..	5 2 2
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	84 — 86	84 — 86	84	..	..	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	4 %	101⅛—103½	101⅛—103½	..	..	..	3 17 10
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	13¼ — 13⅝	13¼ — 13⅝	13 9/16	13¼	..	5 1 10
762,400	Do. 4 % Deb. Stock..	Stock	4 %	4 %	4 %	4 %	99½—101½	99½—101½	100⅛	100	..	3 18 10
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100⅛—102⅛	101 —103	100¼	..	+ ⅛	3 17 8
181,127	Globe Telegraph and Trust	10	5⅞%	5⅝%	5⅞%	..	10⅛— 11 xd	10⅛— 11	..	..	..	5 4 4
181,127	Do. do. 6 % Pref..	10	6 %	6 %	6 %	..	12⅝— 13⅛ xd	13 — 13⅛	13 1/16	..	+ ⅛	4 8 11
150,000	Great Northern Telegraph, of Copenhagen..	10	20 %	18 %	18 %	..	32 — 33	32 — 33	..	..	..	5 8 0
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	..	58 — 60	58 — 60	..	..	..	5 8 4
$41,380,400	Mackay Companies Common	$100	4 %	4 %	4½%	5 %	93 — 96	93 — 96	..	..	..	5 4 2
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	76 — 78	78 — 80	..	..	+ 2	5 0 0
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1	19/-	18/3	+ 1/16	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	..	1 1/16 — 1 1/8	1 1/16 — 1 1/8	20/6	..	..	5 17 1
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	31/32 — 1	31/32 — 1	17/6	..	..	5 11 1
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105	104 —105	104⅜	104¼	..	5 14 3
3,725,000	Do. do. Def. Stock	100	6 %	6 %	6 %	6 %	136 —138	136½—138½	137¾	136¾	+ ½	4 6 8
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10 — 10¾	10 — 10¼	..	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10¼— 11	10¼— 11	..	..	..	5 9 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5½ — 6	5⅝ — 5¾	5⅝	5⅝	— ⅛	4 4 3
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	99 —101	99 —101	99⅛	99	..	3 9 3
1,983,593	Do. do. 4 % Deb. Stock Red.. ..	100	4 %	4 %	4 %	4 %	99 —101	99 —101	99	..	..	3 19 4
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid..	1	8 %	8 %	8 %	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 11 5
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	..	1⅜ — 1 7/8	1⅜ — 1 7/8	..	..	..	4 7 8
195,955	Do. do. do. 4 % Red. Deb. Stock..	100	4 %	4 %	4 %	4 %	87 — 89	87 — 89	..	..	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	98½—100½	99 —101	..	..	+ ½	3 19 7
11,889	Reuter's	8	5 %	5 %	5 %	..	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 17 7
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	96⅛ — 98⅜	96⅛ — 98⅜	..	..	..	4 11 5
2,992	Submarine Cables Trust.	Cert.	6 %	6 %	6 %	..	133 —136	133 —136	..	..	..	4 8 3
150,000	United River Plate Telephone	5	8 %	8 %	8 %	..	7⅛ — 7⅜	7⅛ — 7⅜	7 3/32	..	..	5 8 3
40,000	Do. 5% Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	4 7 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1¼ — 1⅜	1¼ — 1⅜	..	..	..	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	99 —101	..	..	+ 1	4 0 0
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930 ..	10	7 %	7 %	7 %	6 %	13¾ — 14 xd	13¾ — 14	13⅞	13 13/16	..	4 5 9
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101½	..	..	3 19 3
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	2⅞ — 3⅛	2⅞ — 2⅞	60/-	54/1½	— ½	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10⅜ — 10⅝	10⅜ — 10⅝	10⅝	..	..	5 12 11
4,669	Do. do. 6 % Cum. 2nd Pref.	10	£2 6	15 %	14½%	..	9 — 9⅛	9 — 9⅛	9⅛	..	..	6 6 4
80,000‡	Do. do. 5 % Debs., Nos. 1 to 800 ..	100	5 %	5 %	5 %	5 %	101⅛—103½	102 —104	..	..	+ ½	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	5 %	5 %	5 — 5⅛	5 — 5⅛	5⅛	5 3/32	..	4 15 8
500,000	Do. 5 % 2nd Pref., 800,000 to 1,300,000	5	..	..	5 %	5 %	4¾— 5	4¾— 5	98/11½	96/10½	..	5 0 8
4,465,674	Do. 4 % Deb. Stock	Stock	..	4 %	4 %	4 %	92 — 93¾	92 — 93½	92¾	92⅜	..	4 5 7
329,002	Auckland E. Trams, 5 % 1st Mort Deb. Stock ..	100	5 %	5 %	5 %	5 %	104½—106½	104½—106½	..	..	..	4 18 11
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	24 %	..	5⅝ — 5¾	5⅝ — 5¾	..	..	..	4 4 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	4 0 0
600,000	British Columbia E. Rail Def. Ord. Stock	100	8 %	8 %	8 %	..	151 —155	151 —155	153	151	..	5 3 3
600,000	Do. Pref. Ord. Stock	100	5 %	6 %	6 %	..	125 —128	125 —128	126⅝	124⅜	..	4 10 1
600,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	..	108 —111	108 —111	110	108½	..	4 5 9
230,800	Do. 4½ % 1st Mort. Deb., 1 to 6,350	40	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 8 7
210,600	Do. 4½ % Vancouver Power Debs., 1 to 2,300	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
138,301	British Electric Traction	10	Nil	Nil	Nil	..	1⅞ — 2⅛	1⅞ — 2⅛	40/7½	37/6	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	3 %	1½%	Nil	..	4¼ — 5⅛	4 15/16 — 5 1/16	5 1/16	93/9	+ 1/16	Nil
1,478,653	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	..	98 — 97	94 — 98	96⅜	96	+1	5 2 0
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	75 — 80	78 — 83	78¼	..	+3	5 8 5
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6⅞ — 7⅛ xd	6⅞ — 7⅛	7	..	..	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅞ — 6¼	5⅞ — 6¼	..	..	..	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	100 —102	101 —103	..	..	+1	4 7 5
201,579‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
500,000	British Westinghouse 10 % Pref., 1 to 200,000 and 275,001 to 575,000 Non-cum.	5	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/16	7/8	..	..	Nil
1,241,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	59 — 62	59 — 62	..	..	..	6 9 1
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	7/16 — 11/16	7/16 — 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,888	Brush Electrical Engineering, Ord., 1 to 140,338 ..	2	Nil	Nil	Nil	..	1/16 — 1/16	1/16 — 1/16	..	..	..	Nil
199,835	Do. do. Non-cum. 7 % Pref... ..	2	Nil	Nil	Nil	..	1/8 — 1/8	1/8 — 1/8	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	56 — 61	56 — 61	..	..	..	7 7 7
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	38 — 43	38 — 43	..	..	..	10 9 4
187,610	Calcutta Trams, 1 to 187,610	5	6 %	4½%	4½%	..	5⅜ — 5⅝	5⅜ — 5⅝	5⅝	..	..	3 16 7
47,295	Do. 5 % Cum. Pref., 1 to 47,295 ..	5	5 %	5 %	5 %	..	4¼ — 5⅛	4¼ — 5⅛	5 1/16	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
35,000	Callender's Cable Construction shares	5	15 %	15 %	10 %	..	9¼ — 9⅝	9⅜ — 9⅝	9⅝	..	+ ⅛	5 1 3
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	4¾ — 5⅛	4¾ — 5⅛	5 1/16	..	..	4 17 1
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —104	102 —104	102	..	..	4 6 7
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	1/16 — 1/16	1/16 — 1/16	10/6	10/-	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	12 %	12½%	17½%	..	3 1/16 — 3 1/8	3 1/16 — 3 1/16	..	..	..	5 7 8
205,369	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4 %	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
1,854,720	Central London Railway, Ord. Stock	Stock	3 %	3½%	3 %	3 %	72 — 74	72 — 74	74	72½	..	24. 1 1
572,640	Do. do. 4 % Pref. Stock.. ..	Stock	4 %	4 %	4 %	4 %	86 — 88	87 — 89	87½	..	+1	4 9 11
572,640	Do. do. Def. do.	Stock	2 %	2½%	2 %	2 %	55 — 57	57 — 59	59	57	+2	3 7 0
1,480,000	City and South London Railway	Stock	2½%	1½%	1⅞%	1⅛%	34⅛— 35½	34 — 35	35⅜	34	— ⅛	4 5 9
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 1,100 of £50 Red	..	5 %	5 %	5 %	5 %	70 — 80	70 — 80	..	..	..	6 0 5

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1907.	1908.	1909.	1910.	Closing Quotations March 28th.	Closing Quotations April 4th.	Business done week ended April 4th, 1911. Highest	Lowest	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	6 %	5 %	..	⅞ — 1	⅞ — 1	..	..	.	5 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	..	1 — 1⅛ xd	1 — 1⅛	..	..	..	5 6 8
265,480	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12⅛ — 13⅛	12⅛ — 13⅛	..	..	..	4 10 7
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	2½%	Nil	Nil	..	⅜ — ½	⅜ — ½	11/6	..	— 1/16	Nil
17,189	Do. "A" shares, 01—017,189	5	2½%	Nil	Nil	..	1⅛ — 2⅜	1⅛ — 2⅜	37/6	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	69 — 73	67 — 71	73	71	—2	5 12 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	78 — 81 xd	78 — 81	..	..	..	6 3 5
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	¾ — 1	¾ — 1	17/6	16/9	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	..	1½ — 2	1½ — 2	35/-	..	..	7 0 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	8 — 8½	8 — 8½	8 5/16	8⅛	..	5 17 8
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	83 — 88 xd	83 — 88	..	..	..	4 10 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	½%	Nil	Nil	..	1⅛ — 1½	1⅛ — 1½	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10⅛ — 10⅜	10⅛ — 10⅜	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103½	102 —103½	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12 — 12⅜ xd	12 — 12⅜	12½	12	..	5 9 1
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	4⅞ — 5⅛	4⅞ — 5⅛	5⅛	..	+ ⅛	4 6 8
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½%	4½%	4½%	4½%	107 —109	107⅞—109½	107⅞	..	+ ⅜	4 2 2
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	..	16 — 16⅜	16 — 16⅜	16⅜	16 1/16	..	5 19 5
37,500	†Liverpool Overhead Railway, Ord.	10	½%	Nil	Nil	1½%	2⅛ — 2⅜	2⅛ — 2 1/16	..	..	..	5 9 1
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	8⅛ — 8½	8⅛ — 8½	..	..	+ 1/16	5 17 8
600,070	London United Trams. (1901) 1 to 50,007	10	3 %	Nil	Nil	Nil	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
899,930	Do. do. 50,008 to 100,000	10	3 %	Nil	Nil	Nil	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	3½%	Nil	Nil	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	..
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	73 — 77	72 — 75	61/10½	57/6	—1½	5 6 8
5,732,062	Metropolitan Consolidated	100	½%	½%	1 %	1½%	53½ — 53⅝	55 — 55½	55⅝	53½	+ 1½	2 0 7
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	66 — 68	66 — 68	67⅜	66½	..	4 0 11
2,235,000	Do. District	100	Nil	Nil	Nil	Nil	31½ — 31⅝	32 — 32½	32 1/16	31½	+ ⅜	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	4½%	5%	5⅛%	⅞ — 1⅛	⅞ — 1	..	..	— 1/32	5 10 0
314,016	Do. do. Defd.	1	Nil	Nil	Nil	Nil	3/32 — 5/32	3/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	15/16 — 1	17/16 — 1 1/16	17/9	17/3	..	5 9 7
589,183	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	102 —104	102½—104½	103½	102	+ ½	4 6 2
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	6 %	..	125⅝—126⅜	126⅝—127⅜	135⅜	..	+1	4 14 1
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	5 %	5 %	..	95 — 96	96 — 97	97	96	+1	5 3 1
245,000	Potteries Electric Traction	1	4 %	Nil	2 %	..	9/32 — 11/32	9/32 — 11/32	7/-	6/6	+ 1/32	4 11 6
245,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	25/32 — 29/32	25/32 — 29/32	14/4½	13/6	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	85 — 88	85 — 88	..	..	..	5 2 3
37,350	Telegraph Construction and Maintenance.	12	17½%	15 %	17½%	20 %	35½ — 37½	35½ — 37½	..	..	..	6 8 0
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1919	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 5 0
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	5 %	5 %	..	102 —103	102 —103	102⅜	98½	..	4 17 1
2,818,700	Do. do. 4½ % Bonds.	..	..	4½%	4½%	..	98 —100	98 —100	99⅛	..	..	4 10 0
4,928,050	Do. do. 6 % Income Bonds	..	..	..	..	1 %	57 — 59	58 — 60	60	58	+1	1 13 4
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	10 %	5 %	Nil	Nil	⅜ — ½	⅜ — ½	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	6 %	6 %	3 %	Nil	1 — 1½	1 — 1½	..	..	..	..
215,769	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	55 — 65	55 — 65	..	..	..	6 3 1

ELECTRICITY SUPPLY COMPANIES.

80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 80,449	5	10 %	10 %	10 %	10 %	7⅞— 7⅝xd	7⅞— 7⅝	7½	..	..	6 12 3
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7⅞— 7¼xd	7⅞— 7⅝	..	..	—1/16	4 11 10
402,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —103	99 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4⅛	4 — 4⅛	..	..	..	5 11 10
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 2 10
445,786	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	95 — 97	95 — 97	..	..	..	4 2 6
49,486	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	5 %	4 — 4⅛	4 — 4⅛	85/-	84/4½	..	5 11 1
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	7 %	7 %	11⅜ — 12⅛xd	11⅜ — 12⅛	11⅜	11⅜	..	5 19 2
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅜ — 12⅛xd	11⅜ — 12⅛	..	..	..	4 16 0
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	119 —123	119 —123	..	..	+1	4 1 4
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	100 —103	101 —104	..	..	..	4 6 7
50,000	County of Durham Electrical Power, Ord.	5	2 %	Nil	Nil	..	1⅛ — 2	1⅛ — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	7 16 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	5 %	5 %	5 %	92 — 94	92 — 94	..	..	..	5 6 5
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅞ — 8⅛xd	7⅞ — 8⅛	7⅞	..	..	6 3 1
55,000	Do. do. 6 % Pref., 40,001—80,000 and 120,001—135,000	10	6 %	6 %	6 %	6 %	10⅝ — 11⅛xd	10⅝ — 11⅛	11⅛	11	+ ⅛	5 6 8
450,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	108½—111½	108½—111½	110½	..	..	4 0 9
450,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	101 —104	102	..	+1	4 6 7
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	Nil	Nil	Nil	..	2⅛ — 2⅜	2⅛ — 3⅛	65/-	60/-	+ ½	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 3 6
$8,150,000	Electrical Dev. Co. of Ontario, 6% 1st Mtg. Gold Bnds.	$500	..	5 %	5 %	..	81½ — 83½	81½ — 83½	..	..	..	5 17 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	6 %	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅛ — 5⅛	4⅛ — 5⅛	..	..	..	4 11 11
94,350	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	8½%	8½%	8½%	9 %	6⅞ — 7⅛	6⅞ — 7⅛	7⅛	..	..	5 19 4
$1,526,500	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	5 %	5 %	..	102 —104	102 —104	..	..	..	4 16 2
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	8 %	8 %	9 %	7 — 7⅜	7 — 7⅜	7⅜	..	..	5 16 2
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
111,000	London Electric Supply Corporation, Limited, Ord.	3	2½%	3 %	2 %	2 %	1⅜ — 1⅝	1⅜ — 1⅝	36/3	33/9	..	3 3 6
90,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	6 %	4⅝ — 5⅛	4⅝ — 5⅛	96/3	..	..	5 17 1
387,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4 %	4 %	4 %	91 — 94	91 — 94	93½	..	..	4 5 1
200,000	Metropolitan Electric Supply, 100,001 to 300,000	5	6½%	5 %	5 %	5 %	3⅛ — 3⅞ xd	3⅛ — 4⅞	93/9	80/-	..	5 12 8
76,121	Do. 4½ % Cum. Pref. 1—76,121	5	4½%	4½%	4½%	4½%	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	4 17 4
250,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	85 — 88	86 — 89	..	..	+1	3 18 8
$5,929,600	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	88 — 90	90 — 91	90½	89½	+1½	5 9 11
$18,585,000	Do. Light and Power Co., Ltd., Common	$100	4 %	3½%	4 %	..	88 — 90	87 — 89	88½	..	..	4 8 11
$5,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	7 %	7 %	..	108 —111	108 —111	110⅝	109½	..	6 6 2
$ 12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	5 %	5 %	5 %	93½ — 95½	95½ — 96½	96⅜	94½	+1⅛	5 3 8
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	97 — 99	97 — 99	..	..	..	4 10 11
130,491	Newcastle-on-Tyne, 1 to 50,000 & 57,010 to 127,500	5	8 %	2½%	4 %	4 %	4⅛ — 4⅝	4⅛ — 4⅝	..	..	..	4 6 6
127,500	Do. 5% Pref., 1 to 127,500 Non. Cum.	5	5 %	5 %	5 %	5 %	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 2 7
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	5 %	..	97½ — 99½	97½ — 99½	..	..	..	5 0 0
10,852	Notting Hill Electric Lighting	10	7½%	7 %	7½%	8 %	12 — 12⅜	12 — 12⅜	12⅛	..	..	6 5 6
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 8
120,000	River Plate Elcty. Co. Ord.	Stock	6 %	8 %	9 %	..	225 —235	225 —235	..	..	..	3 16 6
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	..	103 —113	103 —113	..	..	..	5 6 2
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 3
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10%	8⅜ — 8⅞	8¼ — 9	8⅜	..	+ ⅛	5 11 1
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅝ — 7⅛	6⅝ — 7⅛	..	..	..	4 16 7
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	86 — 88	86 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	Nil	1⅜ — 2	1⅜ — 1⅞	..	..	— ⅛	Nil
65,000	South London Electric Supply, Ord.	4	4 %	5 %	5 %	5 %	2 1/16 — 2⅛xd	2 1/16 — 2⅛	..	..	..	6 7 0
100,000	Do. do. 5 % 1st Mort. Deb.	100	..	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 3
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	Nil	Nil	⅞ — 1	⅞ — 1	..	..	..	Nil
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	5 17 11
240,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	95 — 98 xd	95 — 98	..	..	..	4 11 10
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	1⅝ — 1 13/16xd	1⅝ — 1 13/16	..	..	+ 1/16	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1 15/16 — 2⅛xd	1⅞ — 2⅛	..	..	..	10 10 6
271,700	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	84 — 86 xd	85 — 87	85½	..	+1	5 3 6
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	5 %	..	..	⅞ — 1	1⅛ — 1	18/9	..	+ 1/32	5 0 0
110,000	Westminster Electric Supply, Ord.	5	10 %	10 %	10 %	10%	7⅞ — 8⅛	7⅞ — 8⅛	7 15/16	7⅞	..	5 19 5
81,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	5 5/32	..	..	4 3 9

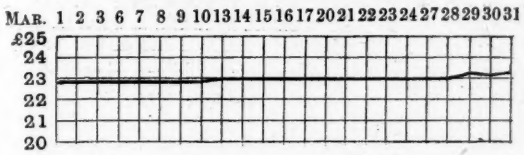
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3 per cent. March 9th. 1911.

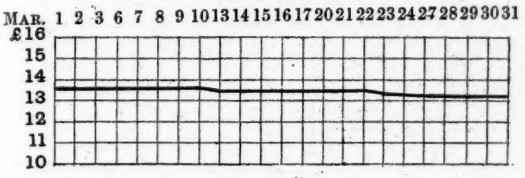
METAL MARKET.

Fluctuations in March.

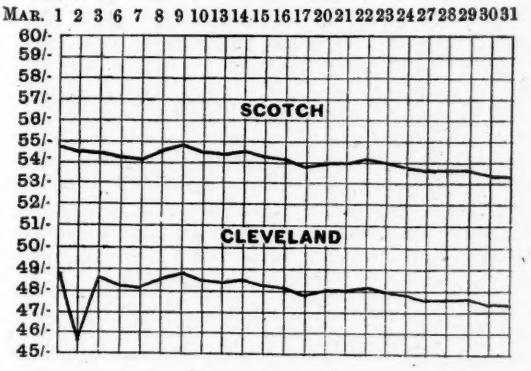
SPELTER (G.O.B's.).



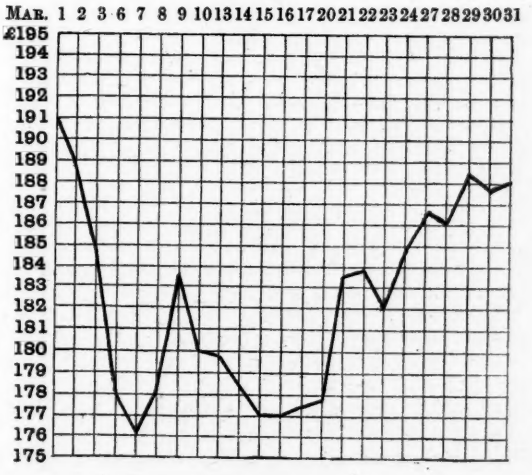
LEAD (ENGLISH).



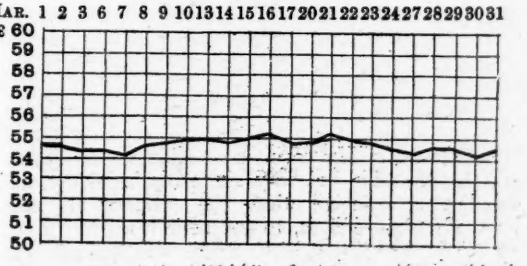
IRON.



TIN.



COPPER (G.M.B's.).



ENGLISH v. GERMAN ELECTRICAL COMMERCE IN THE FAR EAST.

By ALFRED N. SILLAR, M.I.E.E., M.I.Mech.E., Chief Engineer, the Peking Chinese Chartered Electric Light Co., Ltd.

Having read with great interest the articles appearing from time to time in your paper in close relationship with the above subject, I shall be glad if you will find me space in your columns to give my views and experiences of the British electrical trade's total inability to cope with German competition in China.

I claim, as engineer of one of the largest supply stations in China, where the company and board of directors are entirely native, to be able to study the question from the Chinese point of view, and as a resident in the Imperial City, from which most of the large Government contracts emanate, I hope my remarks will be given a little consideration by our home manufacturers.

In the first place, you have only got to reside in this city a day or two when you will notice the great preponderance of Germans over Englishmen, easily 10 to 1, and you further wonder why all these gentlemen speak the English language as well as you do. The reason is obvious. The Chinese have been educated to understand that the most reliable engineering material comes from England, and the high officials all speak our language; but this does not discourage the German, who sends out representatives who have as good a knowledge of English as of their own language.

The Chinese have still got a great belief in the quality of English goods, and like to specify them if they get the chance, but even if they do, the conditions here, where British representatives hardly exist, do not assist them in getting what they ask for.

Perhaps I shall not be believed when I state with truth that I have at present in my generating station two large pieces of machinery, built in Germany, but bearing the name-plates of a well-known British manufacturing firm; when the machines were supplied the directors were fully under the impression that they were made in England!

In my opinion, our loss of ground in the Far East is due to the following reasons:—

The first is the indifference of the Government towards the postal facilities in the North of China and Japan. In Peking, the French, German, Russian and Japanese Governments have their own post offices, whereas all British correspondence is left to the mercy of the native undertaking, which is outside the Postal Union. Now take the German post. All letters from Germany require only a 1d. stamp, and are forwarded by the Siberia route (13 days), no matter whether endorsed or not.

From England the stamp is 2½d., and unless actually endorsed "*via* Siberia," letters are sent by steamer post, which takes six to seven weeks; also any letter which is not accurately addressed or correctly stamped (most home correspondents think 1d. sufficient), is sent by steamer in any case.

The result is that when tendering competitively, British agents are afraid to trust the post for their information, and have to obtain it at great expense over the wires, whereas the German can put absolute faith in his post office.

The Government reply to this is that they have contracted with the steamship company for a number of years, and cannot make any alteration; but that is absurd, as the amount of compensation necessary to cancel the contract would not represent one-tenth of the benefits to be derived from so doing.

The second reason of our inability to compete with Germany is, in my opinion, the fact that our banks will not successfully co-operate with the manufacturers, as has been the case for some time in Germany. At the present time in Belgium and Germany the banks are amalgamating with manufacturers' syndicates, with the result that any scheme with a reasonable prospect of success can obtain financial help when promoted in Germany.

The last and most important reason why we fail in competition is the entire absence here of qualified salaried representatives of our manufacturing firms.

In North China at present there are three or four so-called English manufacturers' agents, each representing a large

number of different firms, who pay a commission on orders received. These gentlemen naturally pick out the most remunerative class of goods to push, and neglect the others which do not pay so well.

They are, as a rule, unable to speak Chinese, are practically unknown in high official circles, and usually can only quote material f.o.b. London or, perhaps, Shanghai.

When first appointed here I tried to get my company to do business with London, but quickly found it unworkable. First, firms wanted the money before shipment, and as they did not know the amount of the shipping charges, it necessitated two bank drafts. Then when the goods arrived at Shanghai or Tientsin, they generally got lost as there was nobody to look after them, and all sorts of annoying charges for railway freight, duties, &c., had to be met before the goods were delivered.

The Germans establish offices in all good centres, employing a salaried business representative who talks English and Chinese like a native, and whose duty it is to become personally acquainted with all the high officials. He is able to quote for all material delivered free of all charges, and he does not ask for a penny except the bargain money, until the goods have been examined and accepted.

The Germans are also as "cliquey" as Quakers. If a German hears that a central station equipment or railway extension is required, he acquaints just as many of his compatriots as will enable him to supply a complete tender, whereas the British agent, if he hears of the job, will not trust his competitors and generally is unable to quote for the whole contract, with the result that the Chinese will not consider his tender.

The Germans have also studied tactfulness by acts of kindness, which Englishmen are not farsighted enough to recognise. When I arrived here a perfect stranger, it was the Germans who spared no effort to make me at home.

When our managing director wanted to give his son a European electrical training, he was immediately offered a three years' apprenticeship in Berlin, free of any premium, and this offer was of course accepted. The result will be that this man will come back here, speaking the German language and thoroughly biassed in favour of their plant. Would any of our manufacturers have made a similar offer?

The remedy seems simple enough if only followed out seriously. First, let the Government give postal facilities to the Far East equal to those given by Germany. Secondly, let the banks co-operate with the manufacturers, so that the same terms of payment can be given to the Chinese by British firms as by German; and, thirdly, our manufacturers, if not singly, should combine to send out smart commercial representatives at a good salary to all the large business centres in China, and establish offices there, and they should be assisted by an engineering expert, who should give technical advice to all the different agencies.

Above all, remember that it is hopeless to sit at home and wait for orders to come, for in China there is no such thing as public tendering, and it is absolutely necessary to be on the spot to obtain contracts. In conclusion, I would say that before writing this article, I had an interview with Mr. H. H. Fox, commercial *attaché* to the British Embassy, and he is quite in agreement with me as to the cause of our failure and its remedy.

BRITISH ENTERPRISE IN THE FAR EAST.

[COMMUNICATED.]

In 1909 I was asked by the Editors of this Journal to write an article on British trade in China. After some pressure, I consented. I was reluctant at first, because, having had little or no experience with the pen, I feared to spoil a great subject by being unable to clearly express my thoughts.

There is a good deal written about apathy on the part of the representatives of British trade abroad; this, to a large extent is true, but in my opinion it is due mainly to two reasons. First, I would take the question of support, and under this heading come two points—*i.e.*, commercial and diplomatic support. I put commercial first, because without it you would have no necessity for the latter. The commercial support obtainable at home is not strong, but I think it is getting better, as the manufacturers are at last realising the importance of the Great Chinese Empire in regard to engineering material. We are now getting a support of a kind, but the next question is that of finance. A firm which lays itself out to push engineering in China must have plenty of capital, and be prepared to lose money at the beginning. A staff of foreigners, with efficient Chinese, should be always on the move in the interior. This is done by the important German houses. The expenses must be heavy; but if China is not to be filled up with German electrical material, Britain must do likewise. The Chinese are now beginning to realise that the foreigner is a pretty useful fellow, even though they do not like him, and would be glad to kick him out; but that being impossible, our Chinese friends are getting all they can by the way of material benefits. Should a Chinese company be formed for any purpose, it has, by law, to pay a dividend usually about 7 per cent., and I might almost say never less than 6 per cent. Now the Chinese are a banking nation, small banks and exchange shops abound, and money is lent out on sound securities for 8 per cent. and 9 per cent., and on a fairly good security they charge anything between 10 per cent. and 20 per cent.; so, say a company is formed to erect an electric lighting station, it often arranges that the plant shall be paid for over a long period, and pays the contractor 6 per cent. on his outstanding accounts. The company lends its own money out to a bank at, say, 8 per cent. to 10 per cent., thereby making a little money to go towards the compulsory dividend until the company's plant is working, and if a contractor is not well supplied with plenty of money he is often left in the cold. This system, I believe, was started by the Germans, and it is a bad policy, but it must be done. I do not say that the German firms in China do the financing, as I think it is done by the manufacturers. If anyone would tell me of a British manufacturer who would work on this basis, I should be very glad to meet him.

As to diplomatic support, we might put it as a negative quantity, because it does not exist. British Diplomatic and Consular officials do not assist at all. I do not think it is the officials' fault, but that of a long effete system based on the rules and regulations made when we were named by Napoleon a "nation of shopkeepers." It is very splendid to boast that our trade is made and maintained on the merits of our manufactures, but now that we have such efficient competitors who have, to a great extent, learned their trade from us, something more than high ideals is required.

Some writers have urged that trade abroad should be carried on by means of a corporation of manufacturers. The idea is ideal, but in practice I fear it is difficult, and we have yet to learn how it is to be done; for instance, in England there are less than half-a-dozen cable-makers of the first magnitude, but how on earth would you get these to work together? This, of course, applies to all branches of our trade. The idea is fine if it could be carried out on a large scale, one should say a universal scale. Should such a corporation ever come to pass, I fear the manufacturers would at once lose sight of the necessity of quoting fighting prices, that is, if the contracts were doled out in turn. To my mind the only way would be to have a central consulting committee, who would not allot contracts in turn, but call for tenders and submit the lowest and best to the prospective purchasers.

Some such Corporation has, I believe, been formed in Berlin; details are not yet to hand, but I feel certain a very progressive policy will be adopted. The energy and assiduity of our German cousins call for nothing but admiration, even if it is tempered with envy at their resources. I know of an instance where over £2,000 was lent or given to the promoter of an electrical scheme to allow a large price to be put in. As it is at present, and as I have said before, the British manufacturers are beginning to realise the meaning of China, but they are proceeding slowly, and are spending a sovereign where the Germans are spending hundreds of sovereigns, to get their machinery in. I am optimistic, however, and feel certain that it is only a matter of time before our British manufacturers will appreciate the

difficulties their agents and representatives have to meet with in competition with foreign agents, who are so much better supplied with ready money, and then I think we shall sweep the board, as British material is always more popular than that coming from other countries.

It would benefit all concerned in the promotion of British trade abroad, if they would read the letter recently written by Lord Furness to the *Times*, which appeared to me to be full commonsense and truth. Although Lord Furness is, as he of says, a convinced Free Trader, I cannot but feel that if we had a retaliating tariff, which would to an extent keep out the vast quantity of foreign machinery imported into the Homeland, our manufacturers might to some extent follow the system of "dumping" with which we outposts of our country have such difficulty in competing. Anyhow this article is not political, for I think that when the question of consolidation of the Empire, the maintenance of the British trade, and the other interests of our beloved country is concerned, party cries should be dropped, and Imperialists should band together with one unselfish thought, that of keeping the British Flag far above all others in the matter of commerce and the protection of our boundaries.

PUBLICITY.

By "TRUMPETER."

One would like to begin this article by remarking, with happy confidence, that no introductory word upon the importance of "publicity" is needed. Unfortunately, and despite the advance we of the electrical trade have made within the last few years, that is not the case. I do not suggest that any of us is so foolish as to imagine that he need not advertise at all, or that his goods will "advertise themselves," and that he is independent of the printer, the Press and the post. Everybody who has something to sell knows that the Press, at any rate, must be used. We all purchase space in one or more of the trade papers—some of us every week, some once a fortnight, some less often. Having done so much, or so little, many of us rest content. The matter is of no account. Put our name at the top or the bottom, throw in an illustration or two —which, so far as the prospective buyer is concerned, would serve equally well to illustrate the products of Jones, Smith or Robinson—and fill up. That is the only point upon which we insist—we must fill up. We have paid for this space, and we mean to use it, and we don't mean to leave a ½-in. square of white paper within its bounds. And so we succeed eminently in producing an advertisement which nobody sees.

Ask such people why they advertise at all, and they will tell you that they advertise because their competitors do. They don't like advertising; it is an expensive game, and they would be only too glad to do without it. It *is* an expensive game—for them—for the very reason that they do not like it. But there are people who do like it; people who attach as much importance to the turning out of a good advertisement as to the turning out of a good dynamo, or lamp, or meter or whatever article they manufacture. Why? Because the one must be good enough to sell the other. And these are the people who, as we say, "come out on top"; for them the game is a paying one.

The Advertisement and the Article.—I have said that these people attach *as much* importance to the production of a good advertisement as to the production of a good article for sale. I repeat it, because I wish to make it clearly understood that the article advertised must itself be good. Clever advertising may sell a bad article in, say, the patent medicine trade; I daresay it often does, but it will never do so in the electrical trade. The electrical man who has a poor article to sell may as well close his advertising account at once; and having done that, the sooner he shuts up shop altogether the better for his pocket. On the other hand, bad advertising will fail to sell a good article, and a shop that might well have been kept open will soon follow the other's example.

The following suggestions, therefore, are for the man who has a good article to offer; the man who has not, is advised to put the paper down, and go and look after his shutters.

Press Advertisements.—In view of the great variety of apparatus produced by electrical manufacturers, it is impossible to suggest a list of suitable periodicals for each class. It may be laid down without hesitation, however, that the leading (electrical) trade journals must be used persistently. Through their medium the advertiser reaches central station engineers, consulting engineers, electrical engineers in charge of works installations, and last, but not least, the contractors. The maker of instruments finds the whole of his potential buyers in this field. So do the suppliers of carbons, switchboard fittings, and similar details used by the trade only. On the other hand, the manufacturers of machinery, starters, lamps and lamp fittings, must cover a wider area.

Of electrical advertisers, the lamp makers seem to be the most wideawake, and it would be difficult, if not impossible, to name a suitable medium which is not already on their active list. But I do think that the machinery makers might with profit extend their advertising area. There is no machinery-employing industry into which the electric motor is not capable of entry, and none already entered, in which its use is not capable of almost infinite extension. Yet advertisements of electrical machinery in the Press of other trades are few and far between. I do not suggest that the idea of advertising in such journals has not occurred to our manufacturers, but I am forced to the conclusion that, with one or two exceptions, their efforts have been spasmodic, and, for that very reason, unprofitable. Spasmodic advertising is useless. If So-and-So's Pills were advertised in a haphazard fashion with long intervals between appeals, So-and-So's Pills would almost immediately cease their beneficent work upon the stomachs of mankind. To those who are inclined to consider or re-consider this question of advertising outside the group of electrical trade journals as well as within it, and yet are not convinced that the expense of a general campaign in the wider field would be justified, I would say: Tackle *one* good journal, advertise in it well and regularly, and at the same time post suitable literature to people engaged in the trade which the selected journal represents. That is the only way to test, cheaply, the value of outside advertising. To advertise occasionally in a dozen or a score of different journals is merely to throw money away. It is the "insistent appeal" that tells.

The Form of the Advertisement.—Glance intelligently through the advertisement pages of our journals, and it will be obvious to you that recognition of the necessity for attractive advertising is growing amongst us. At one extreme you have the advertisement of the old school, messy and over-full, a mere rag-bag of capital letters, featureless illustrations and other odds and ends; at the other the advertisement which is neither messy, nor idiotic, nor flamboyant, nor comic, nor artistic after the manner of—shall I say?—Victorian wallpapers, but does what it sets out to do, namely, advertises. And between these extremes you have a large number of advertisements in various stages of travail; the advertisements which provide the sign of the times; the advertisements which prove that the trade as a whole does realise the necessity for originality in Press publicity, and does want to get away from the rag-bag standard.

Now, although it is comparatively easy to recognise a good advertisement, the production of one is another matter. No one in his senses would copy a successful advertisement, and, by the same token, it is impossible to give examples and to say that is how an advertisement should be drawn up. Advice and warnings of a general character, however, can be set down. In the first place, and all along, the advertisement designer must bear in mind that originality and good arrangement are not ends in themselves; he must never for a moment forget that his only object is *to advertise*. When he has drawn up his advertisement, let him forget how clever, and how original, and how æsthetic it is, and ask himself, "Will it arouse interest, not only in itself, but in the goods it purports to advertise?" If that question cannot be answered satisfactorily, the cleverness, the originality, the æstheticism are wasted.

In a Press advertisement the clear white space is as valuable and as important as that which is occupied by

illustration and matter. There must be a point to which the eye is guided. The "point" may be a half-tone reproduction, a phrase, a name, a word, but you can only attract the eye to it by proper "balance" and careful avoidance of overcrowding. Having brought the eye quickly to that point, you have the opportunity of giving it something of interest to read about your goods. "Balance," by the way, has nothing to do with precise symmetry. An advertisement having some such arrangement as a half-tone in the centre, the advertising firm's initials at the top, the same at the bottom, and the same at either side, is good for nothing, unless it be to reveal the fact that, as a child, its designer owned a scrap-book.

As to illustrations, if machinery is being advertised, there is no better medium than a good half-tone block; and the illustrations should show the machinery "installed." The man, for instance, whom you want to interest in the electrical driving of printing presses, will not care a straw about the particular shape of your motor; but if you can show the application of motor drive to printing machinery you will probably gain his attention, and be able to impress upon his mind the fact that *you* make motors, and that *your* motors are suitable for driving his presses.

Line drawings I would use very sparingly, although, for its own sake, I love a good line drawing better than anything else in the illustration world. No doubt it is this predilection that has led me, at first glance, to hail with approval some of the line illustrations of turbo-generating sets and other machinery that have recently come into vogue. On second thoughts, however, I have found two serious objections to their use. The first is that a line drawing conveys the impression that it is a product of the imagination, whereas a good half-tone says at once that the machine illustrated has actually been made. The second, that the practical observer is baulked by the comparative indefiniteness of points of detail. These objections, of course, do not apply in the case of every advertised article, and the line drawing has its uses—particularly for the pictorial advertising of such articles or apparatus as are offered for sale to the wider public.

Low comedy should never be indulged in. The industrial buyer may be as appreciative as anyone else of comic drawings and humorous verse—out of business; but in business he is usually irritated by them. Even if he does not consciously object to them, they are not calculated to give him the impression that the advertiser himself means business.

Block-type words and phrases, intended to arouse curiosity, should be chosen with great discretion. They must justify the boldness with which they compel the reader to go further and to discover what they draw attention to. There must be analogy between them and the matter or illustrations to which they are attached, and the analogy must not be strained. You might arrest the attention of every reader by placing the word "damnation" in the middle of your advertising space; but your ultimate purpose would fail, because the only analogy between that startling word and the rest of your advertisement would be an unintentional and entirely malevolent one. Again, you might use the auctioneer's phrase, "Going! going! gone!" and effect analogy by saying that that was how your goods were selling; but the whole effort would be puerile and not businesslike.

The Printer and the Post.—Judging by the press notices of new publications—catalogues, booklets, leaflets, "folders"—the engraver and the printer must have a very good customer in the electrical trade. Most of these productions are designed and executed in an admirable manner; a happy state of things due, I have no doubt, to the fact that the "get up" is usually left to the printer, who employs highly skilled designers for the work.

In such publications, half-tones should be used exclusively, except, of course, for the cover design. A word as to the blocks may not be out of place. The engraver seems to think that his sole duty is to produce as beautiful a half-tone as possible; and, in my experience, the higher the reputation of the engraver the more fervently does he hug that fallacy. What the *advertiser* should aim at is to secure a good representation of his machine. The aerograph and the brush are indispensable—if only to rectify the camera's omissions and exaggerations. But the publicity man must take a firm line with the engraver, insisting, for instance, that a cast surface, such as the yoke of a motor or generator, should be made to look like a cast surface; a smooth cast surface, of course, but not like bright machined work. The engraver will probably weep tears of gall; yet the business of advertisers is to advertise, not to help engravers to realise an ideal.

As in Press advertisements, so in booklet work, an illustration that shows a machine "in commission" is a thousandfold more effective than one that depicts the machine alone.

Booklets should specialise. The same booklet should not deal with motors, generators, meters, lamps. Generators and main switchboards can go together, because they are generally purchased by the same man, to be installed in the same place. If sufficient material is available, motor literature can well be sub-divided into booklets dealing separately with motor installations in the various greater industries. The letterpress should be written in plain language, possessing good literary style without literary affectation. The general industrial buyer should not be allowed to feel that the advertiser considers him to be as a sucking babe in knowledge of things electrical; on the other hand, highly technical language should not be indulged in. Again, matter which deals with installations actually made and savings actually effected is much more impressive than that which merely purports to show how an installation ought to be made and how savings could be effected. Padding should be left to novelists and clergymen. If an advertiser has nothing to say as an accompaniment to his illustrations, let him say nothing.

An addressed and signed letter—again without padding—should be sent out with each booklet, referring to the enclosure, drawing attention to its main points, and offering to submit estimates.

The Publicity Man.—I have no quarrel with the schools of advertising; the vast improvement in the quality of general advertising in this country is a tribute to their value. But the best man sent out by the schools is of no use in the electrical trade unless he have electrical knowledge. A well-trained man can advertise a biscuit without knowing its technicalities, but the electrical advertiser must have a working knowledge of electrical engineering. He need not be able to design a machine; he must know all about its construction, its capabilities and its applications. Let the electrical man go to school if you like, but do not take the mere school man into the electrical trade.

The publicity man must be a man of ideas, having breadth of mind rather than depth, possessing general knowledge, that real literary ability which is essential to the good yet unaffected style which I have demanded, and an "eye for effect." He must be willing to listen to the advice that pours upon him from every quarter, strong enough to refuse it if in his judgment it is valueless, and sufficiently tactful to keep on good terms with everybody upon whom he must rely for information. Needless to add, he must keep intimately in touch with each of the departments—works, design, sales—that bear upon his business.

PROCEEDINGS OF INSTITUTIONS.

Electricity Meters, with Notes on Meter Testing.

By H. A. Ratcliff and A. E. Moore, Associate Members.

(*Abstract of paper read before the* Institution of Electrical Engineers, *Manchester, March 21st, and London, March 23rd*, 1911.)

At least 5 per cent. may be lost in distribution, due to defective meters; consequently, it pays to test meters properly before fixing, and also at regular intervals afterwards. Most of the well-known makes of meters, if properly adjusted and carefully fixed, may be relied upon for about five years; but after that time it certainly pays to have them brought in for thorough overhauling and recalibration. Old meters, after careful repairing and recalibrating, are frequently better than when new, and the cost of the work, if carried out in a properly equipped meter department, is comparatively slight.

In the case of large power consumers extreme accuracy is essential, and it is always advisable in such cases to install duplicate meters.

Direct-current Meters.—The authors are of the opinion that the watt-hour meter is the only type of meter which should be legally recognised as a measurer of electrical energy. The ampere-hour type of meter can only measure energy correctly on the assumption that one of the factors—viz., voltage—is a constant. Watt-hour meters also possess the advantage that they may be made to start with extremely small currents.

The pressure-circuit loss in a watt-hour meter is very small, and has a load factor of 100 per cent., so that the revenue loss to the station has to be reckoned on the lowest possible basis, and will, in any case, hardly exceed ¼d. per unit. Now, ampere-hour meters also have their losses; every station engineer usually runs with a pressure on the distributors rather over, than under, the declared value. Meters of the ampere-hour type, however, must be calibrated for the declared pressure; it follows that 2 per cent. or more of the revenue is lost, and the greatest loss is naturally at the time of peak load, when the cost per unit is at its maximum.

As an example, take the case of a 10-ampere 200-volt meter; the shunt losses in one of the watt-hour type would not exceed 4 watts, and at ¼d. per unit this amounts to 8¾d. per annum. The corresponding loss in an ampere-hour meter, assuming an average load equal to half full load for 1½ hours per day, would be equal to 2 per cent. on, say, 247 units, which, at 3¾d. per unit, is equal to 3s. 2d. per annum. It must, nevertheless, be admitted that ampere-hour meters possess many advantages, and, in some cases, are undoubtedly more suitable for the particular conditions obtaining. They are much simpler to test and install than watt-hour meters, easier to repair, less liable to get out of order, and cheaper than the watt-hour type.

Probably 80 per cent. of the D.C. meters used in this country belong to the mercury motor class, and represent the output of two firms that have had extensive experience with this type of meter. These meters are thoroughly robust; the workmanship is rather rough, but sufficiently finished where essential. The accuracy is reasonably good, they are fairly easy to adjust and calibrate, and repair work is comparatively simple. The greatest objection to this type of meter is the impossibility of maintaining a sufficiently high driving torque as the current-carrying capacity is reduced, a very important point now that the average size of meter is falling. Mercury troubles are necessarily an inherent defect of the type, the most frequent forms being amalgamation, and oxidation of the mercury. Amalgamation can be prevented for several years by careful platinising and enamelling. The old covered armatures made by one firm several years ago have been found in good condition after nine years' use. The oxidation trouble when very bad results in the complete conversion of the mercury to a grey powder. Meters in which a comparatively large current is taken through the mercury chamber (say 50 to 100 amperes) are subject to another peculiar effect which appears to be partly, if not entirely, of an electrolytic nature, the copper of the positive electrode or anode being taken into solution and deposited at the negative electrode or cathode. It is now usual to shunt all sizes above 50 amperes, and some makers shunt above 10 amperes or even less. Shunting has the additional advantage of reducing the somewhat considerable temperature error. The commutator type ampere-hour meter is of Continental origin, and has been on the market for about 12 years; its defects are, however, gradually becoming recognised, and it is therefore probable that it may eventually be superseded by a superior type. This class includes all meters in which a wound armature connected in parallel with a low-resistance shunt rotates in the field of a permanent magnet. The only advantage of this

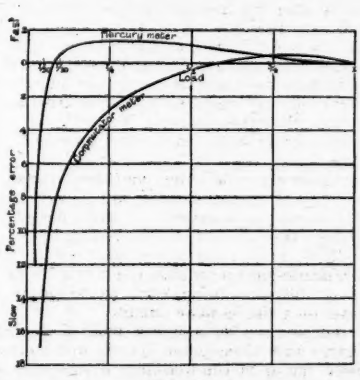


FIG. 1.

type is that the torque may be maintained practically constant independently of the rated current-carrying capacity, as owing to the extremely small current taken by the armatures, and the use of a shunt, the potential difference on the armature terminals may be adjusted to any desired value (within the limits of permissible voltage drop) irrespective of the current rating.

The usual drop in the shunt is from 1 to 1·5 volts at full load. The general construction is, as a rule, rather flimsy. The torque may be very high, but is, of course, obtained at the expense of voltage drop.

The two curves in fig. 1 have been plotted from the mean results of a large number of tests on different makes of meters, and are characteristic of the mercury motor and commutator types respectively.

In the opinion of the authors, the disadvantages of electrolytic meters so completely outweigh the advantages, that they can hardly be regarded as cheap, even at the present low prices.

It has been stated that these meters are dead accurate on all loads, even down to 1 per cent. or less of full load; but the experience of the authors does not substantiate this, since it has been found by direct comparison that reliable motor meters are more accurate than electrolytic meters on the higher loads, and quite as accurate on the very low loads.

Admitting the low price to be an advantage, the following are a few of the disadvantages of electrolytic meters generally:—Delicate and unmechanical construction; impossibility of reasonable repair; difficulty and expense of testing under working conditions; high voltage drop; difficulty of correct reading; difficulty of correct resetting; destruction of record by resetting; no check on "set-up" or "removal" readings; many are dirty and messy in operation; life certain to be short, and the cost of renewals probably 50 per cent. of initial cost of meter.

In the authors' opinion, the destruction of the record is a very serious matter, and the registering device in all meters should be a continuous one.

The only electrolytic meters that have come into extensive use are the "Bastian" and the "Reason." The former is necessarily a total current meter, and is of the water decomposition type. It has an abnormal voltage drop (about 3 volts at full load) and requires periodic refilling. If working for prolonged periods at loads approaching the rated maximum, errors may be introduced due to evaporation. Correct reading of the scale is difficult after the meter has been in use for any length of time, and practically impossible when the current is passing through the meter.

The "Reason" meter is a shunted one, and has a drop of 1 volt at full load. It belongs to the metal-deposition class, and requires no renewal of electrolyte or electrodes. The metal deposited is mercury, and can be used over and over again. The meter is very fragile, and by no means easy to reset properly. Repairs are expensive, and should they become a frequent necessity, will be fatal to the success of the meter. The present design, in the authors' opinion, suffers from the disadvantage that, in order to fix the meter, it is necessary for the fixer to expose the delicate interior, and, moreover, work with his screwdriver in immediate proximity to a slender glass tube.

With one or two exceptions, direct-current watt-hour meters are all of the true dynamometer type, and usually have rotating or oscillating volt-component coils. The well-known Elihu Thomson meter was the prototype of the former class. The mechanical friction is usually counter-balanced by a slight torque due to the magnetic field of a small coil placed in series with the armature. In one well-known meter, the armature, instead of revolving, merely oscillates through an angle of about 30°. A commutator is therefore unnecessary, as the armature need only consist of a single coil; the shunt circuit is never completely interrupted, but the current through the armature is periodically reversed. As the connection between the oscillating spindle and the counting train is purely electrical, the latter may be fixed at any reasonable distance from the meter. The chief objection to the electro-mechanical operation of the counting train is the necessity for employing ratchet gears.

The oscillating type of meter is somewhat complicated, and faults are rather difficult to locate, but meters of this type are remarkably accurate, and as they are usually well made, the accuracy is maintained over long periods, unless there is any change in the strength of the permanent magnets. These meters are not suitable for use on A.C. circuits.

The simple revolving-armature type of dynamometer watt-hour meter with closed-circuit armature has many good features, and if properly designed, and sold at a reasonable price, should be a serious rival to the mercury-motor ampere-hour meter.

The small-diameter commutators so frequently used appear to the authors to be very unsuitable, and probably better results are obtained with robust commutators having a greater number of segments, connected to multi-coil armatures of fairly large diameter. Probably the best forms of brushes are those making a number of separate and independent contacts, the pressure of the brushes on the commutator being controlled by special springs, and not dependent in any way on the natural springiness of the brushes themselves. Bottom, or footstep bearings, are a frequent source of trouble. Only the finest jewels should be used, and a rounded or spherical-ended shaft is to be preferred to a pointed one. There appears to be scope for the design of a reliable ball-bearing for this purpose. The removable spindle tips used by one well-known firm are a distinct advance. The cramped design of these meters is responsible for most of the troubles in connection with the initial calibration, and also the permanency of the calibration, since permanent magnets will not withstand the severe conditions which it imposes.

When great accuracy is required, it is necessary for this type of meter to be wound astatically.

The well-known Aron clock meter is probably the most complicated (mechanically) and, at the same time, most accurate and reliable watt-hour-meter made; it is a true dynamometer, and may, with slight alteration, be used for a wide range of measurements, both direct and alternating, and on either simple or multi-wire circuits.

There are several patterns of the Aron meter, but the main differences between these are the methods of connecting the pendulum coils. The D.C. total-current type, and all A.C. meters, have the pendulum coils in the volt or pressure circuit, whereas in the D.C. shunted type, the pendulum coils carry a portion of the line

current. The shunted type of meter cannot be used on A.C. circuits.

The Aron meters are true watt-hour meters; are astatic, and therefore not affected by stray fields; contain no iron or permanent magnets (but in the D.C. shunted type the volt coil flux is concentrated by means of laminated iron stampings forming a definite magnetic path); are not affected by momentary overloads or short circuits; temperature error, except in the shunted type, practically *nil*; accuracy practically constant at all loads and for long periods of time.

On the other hand, testing is both difficult and tedious, and unless extreme care is taken with the tests, inconsistent results are obtained. It is impossible to make a rapid time test at any particular load, or even to ascertain quickly whether the meter is working approximately correctly, unless the load is a fairly heavy one. It is very difficult to avoid a slight creep, either forward or backward, which may cause apparently considerable errors, when working either on very low loads or with long intervals on open circuit. It is essential that the meters should be fixed perfectly plumb, and if mounted on wooden boards, trouble may arise due to the warping or shrinking of the wood. Poor insulation of the commutator occasionally results in carbonisation and partial shunting of the pendulum coils, the meter then registering slow.

Pitting of the pendulum arbor pivots is a particular and rather frequent source of trouble. It appears to be due to chemical action caused by the vulcanised fibre blocks used for insulating the terminals of the leading-in wires. The experience of the authors leads them to consider any form of vulcanised fibre to be unsuitable for use in the construction of meters and instruments, &c.

Owing to the somewhat complex details, very careful construction and adjustment are necessary, otherwise mechanical faults are apt to develop. The location of faults is rather a difficult matter, and repairs are expensive, owing to the skilled workmanship required.

The total-current type is the only one suitable for house-service conditions, and is the best type for station work up to about 2,000 amperes. Above this size the use of the shunted type is quite legitimate, provided that the necessary precautions are taken.

The advantages of the shunted type are:—

Connections are much simplified, as the shunts may be joined in circuit at any convenient place, and connected to the meter by means of comparatively small leads. Severe mechanical strains on the meter are also avoided. The meter may be removed for testing or adjustment without disturbing the station circuits. If the resistance of the shunt is carefully measured, the meter may be tested with a small current on a shunt of higher resistance giving the necessary voltage drop, and by this means, long-time tests may be conducted in the test-room with great accuracy and ease, and with quite a small expenditure of energy.

The disadvantages of the shunted type are:—

The relatively high temperature coefficient, which is about 0·13 per cent. per degree F.; and the possibility of error due to the various contacts in the pendulum circuit working loose. There are about 24 clamped connections in a meter. Experience has proved that for reliable working it is absolutely essential that most, if not all, of these connections should be soldered; neglect of this precaution means that the meter will gradually register slower, no matter how carefully calibrated.

After considerable experience with most makes of watt-hour meters, the authors consider that a type free from permanent magnets, such as the Aron meter, is the only type capable of withstanding the severe conditions which exist in large D.C. generating stations. Overloads and external magnetic fields are sufficient to destroy the calibration of all meters containing permanent magnets.

The authors' experience is that the mercury type watt-hour meter is very unreliable.

Speaking generally, it may be safely said that shunts are always more or less undesirable on any type of meter, but particularly on service meters; and their use should be avoided as much as possible for all meters not exceeding 1,000 amperes current capacity.

The authors' experience leads them to form the definite opinion that there is not on the market a meter capable of withstanding for any length of time the severe conditions obtaining on a tram-car. That these conditions are exceptionally severe is sufficiently proved by the condition of meters that come into the test-room for checking (and usually repairing), after having been in commission for comparatively short periods.

Commutator type watt-hour meters are not suitable for car work. Owing to the lightness of the revolving parts, and the cushioning effect of the mercury, there is no doubt that the mercury motor ampere-hour type of meter gives the best results for this class of work. At present, however, the enormous momentary overloads, and the excessive vibration, are quite sufficient to alter the strength of any permanent magnets, and even when a very large proportion of the current is shunted, the life of the mercury is very short. The shunting also causes considerable inaccuracies, as the meter gives no indication of not working properly, long after the accuracy has completely disappeared.

Alternating-Current Meters.—The commutator type of dynamometer meter is suitable for alternating-current circuits, and should be capable of development as a standard type, but the error on low power factors is, as a rule, rather considerable on the low-voltage ranges, owing to the high inductance of the armatures, unless neutralised by eddy currents. This is rather a serious matter in the case of 100-volt meters working off the secondaries of pressure transformers.

The Aron meter is, perhaps, the best example of a universal dynamometer watt-hour meter. Owing to the high resistance of the pressure circuit, and the relatively large proportion which is non-inductive, the error on low power factors is not very great. Experiments have shown that this meter can be used on any frequency and wave-form, the only portion requiring any special adjustment for different frequencies being the winding gear.

For station work and heavy service conditions, where accuracy and reliability are essential, the dynamometer types of meter are to be recommended, but for ordinary service work, or even on switchboards, the induction type is now almost universally used. Induction meters have the great advantages of small size, lightness, cheapness, ease of adjustment and fairly constant calibration, provided that the strength of the permanent brake magnets does not vary to any appreciable extent. The shunt, or volt coil losses, in the induction meter are very much lower than in the dynamometer type.

The great objections to the induction type are the small driving torque and the variation in accuracy with varying wave-form. In several recent designs, however, the torque has been considerably increased.

Fig. 2 shows two curves characteristic of induction type meters. The rapid falling-off in the speed of the meter at the overloads is due to the fact that the driving fluxes also act as braking fluxes, and the effect becomes very appreciable at the higher loads because

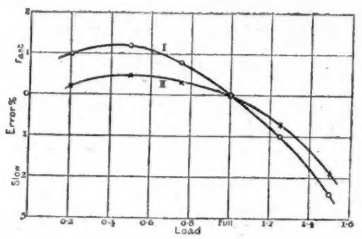


FIG. 2.

this brake torque increases as the square of the fluxes. The two curves are plotted from observations made on the same single-phase meter. Curve I was obtained by adjusting the permanent brake magnet so that a minimum braking effect was produced, and the speed of the meter at full load was then about 50 R.P.M. Curve II was obtained by adjusting the magnet so that the maximum braking effect was produced, and the speed of the meter at full load was about 30 R.P.M. It is seen that the motor gives a more uniform curve of accuracy when the braking effect of the permanent magnet is increased. In plotting the curves the meter was assumed to have no error at full load in both cases.

Alternating-current meters are essentially of the watt-hour type; there are many difficulties in connection with the manufacture of a reliable A.C. ampere-hour meter.

The best way of making the quadrature adjustment in induction meters is to test the meter with a lagging and a leading power factor, and also at unity, say, 0·5 lagging, unity, and 0·5 leading. When the meter has been adjusted until the error under these three conditions becomes approximately the same, the quadrature may be regarded as correct, although if checked with an indicating watt-meter of the dynamometer type, it may be found that the meter has a slight creep when the wattmeter reads zero, the explanation of this being the error in the indicating wattmeter caused by the inductance of its pressure circuit.

Dynamometer meters are unsuitable for working off current transformers if intended to be used on circuits having very low power factors, because the error due to the inductance of the volt coils is intensified by the effect of the lead in the transformers.

Tests made on a dynamometer meter of a well-known make showed that the eddy currents induced in the metal cover were more than sufficient to counterbalance the inductance of the armature. The meter registered slow on inductive loads with the cover on, and fast when the cover was removed.

The temperature error in dynamometer meters is, as a rule, fairly high.

Polyphase meters are now extensively used for measuring the energy on three-phase circuits. Many of the so-called polyphase meters are only single-phase meters, and their measurement of the three-phase energy is based on one or more assumptions.

The only reliable meters are those consisting of a combination of two or more single-phase elements, the construction and arrangement of the combination being such as to admit of its being accurately tested on a single-phase circuit.

The only reliable and satisfactory method of measuring the power in a three-wire three-phase system under all conditions of load and power factor is the well-known two-wattmeter method, and the equivalent arrangement of two watt-hour meters is the most satisfactory method of measuring the total amount of electrical energy supplied. On a four-wire system three meters are required, or, generally speaking ($n - 1$ meters), where n = number of wires. This rule is applicable to either a D.C. multi-wire system or an A.C. system with any number of phases, provided that the minimum number of wires be used.

For convenience and simplicity, it is usual for the two necessary watt-hour meters to be contained in the same case and to integrate on a common set of dials, but when used under these conditions it is essential that the requirements of the two-meter method should still be fulfilled.

The so-called permanent magnet constitutes a most important feature of practically every type of motor meter, and should, there-

fore, be both well made and thoroughly reliable. There is no comparison between the use of permanent magnets in indicating instruments of the moving-coil type and in integrating meters.

Intense magnetic fields may be produced by the series coils of a meter in case of a short-circuit or momentary overload, and the means taken to shield the magnets from the effects of such fields are quite inadequate, and, in some cases, even help to concentrate the action of the stray fields on the permanent magnets. The effect of local stray fields in large generating stations is enormous, and is far greater than is generally realised. One of the authors has seen a dynamometer watt-hour meter stop at about one-third load, and actually reverse at one-quarter load, due to the effect of a stray field, which was obviously stronger than the field of the meter's own current coil.

It is essential that the magnets in station meters should be shielded as completely as possible, and the torque-producing portions of the meters should be astatically wound, for A.C. meters and instruments may be affected by alternating magnetic fields in synchronism with their own self-induced fields.

Meter Testing.—In the opinion of the authors, no effort on the part of the designers or the manufacturers should be spared to bring the errors of meters down to the lowest possible value. Until a satisfactory commercial meter can be produced at a reasonable price and having an error not exceeding 1 per cent. under all reasonable conditions of working, there is room for improvement in design and construction.

It is distinctly inadvisable to extend the legal permissible limits of error, unless it can be shown that meters cannot be brought up to this standard. The authors' experience is that meters can be satisfactorily manufactured to even closer limits than the legal specification, and small initial errors are conducive to reasonable accuracy over a considerable period of time.

All the instruments used for verification purposes should be substandards, and should be verified at frequent and regular intervals by comparison with secondary standards. It is not an uncommon experience to find meters being tested with ammeters and voltmeters which can only be relied on to within 2 or 3 per cent., giving a possible error of 4 to 6 per cent. in the product of the readings of the two instruments. Another common mistake is to use the same range on, say, an ammeter, to test the meter at all loads from full load or over, down to $\frac{1}{20}$ load, so that the lower readings are taken on a very small length of the ammeter scale. This procedure gives rise to considerable errors of observation at the lower loads independently of the accuracy of the ammeter, and the fact must not be overlooked that it is often of greater importance for the meter to be accurate at half or quarter load than at full load. A consumer's meter on a lighting load is probably rarely subjected to full-load conditions.

The connecting-up of meters for testing is of considerable importance, especially if the current capacity of the meter is as high as about 300 amperes or more. Most meters have a temperature coefficient, and in some cases this is as high as 0·25 per cent. per degree F. For meters to attain the correct steady temperature, particularly those of large current-carrying capacity, it is necessary

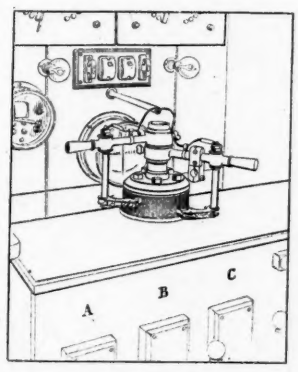


FIG. 3.

to have both shunt and series coils excited, the meter running, and to take care that no undue heating takes place due to bad contacts at the connections.

In the case of D.C. meters the current and pressure for testing purposes are best obtained from secondary cells, as greater constancy is then maintained than when they are obtained from generators. For testing alternating-current meters the apparatus required is much more complicated.

The indicating wattmeter is perhaps the most important of the testing instruments used. Splitting the metal formers and supports in dynamometer wattmeters is not effective in eliminating eddy currents, and instruments of this type containing metal plates or formers, split or otherwise, will be liable to error introduced from the effect of eddy currents when the power factor is other than unity.

For the production of the necessary alternating current, one generator, with suitable transformers for the voltage and current circuits, or two generators of the same frequency, coupled rigidly together, one to supply the pressure and the other the current circuit, may be used. If the loads on the machines are appreciable, compared with their rated output, it is advisable to work always with a strong field. Wide changes in voltage for the pressure circuit may be obtained by using a transformer with suitable tappings on the secondary, and changes in the current in the series circuit may be effected by means of a regulating resistance in the secondary or meter circuit of the low-voltage transformer, to avoid variation in the wave-form of the secondary.

Resistances must never be connected in series with the pressure coils of induction meters for the purpose of regulating the voltage applied to the coils.

The adjustment of the frequency presents no difficulty in these days of interpole motors, and frequency meters of the vibrating reed type are found to be quite satisfactory.

In order to be able to adjust the power factor to the required value, some reliable form of phase-adjuster is essential. Choking coils and condensers are excluded, and the best method is to use two alternators of the same frequency coupled rigidly together, but with the stator of one machine arranged so that it may be turned relatively to the stator of the second machine.

Such a set of machines, manufactured by the British Westinghouse Co., has been installed in the School of Technology, Manchester, and has been in use for the last 16 months, proving extremely useful and convenient for the purpose.

A phase transformer is a very convenient device, and is, perhaps, best suited to supply the pressure circuit. An ordinary three-phase induction motor with slip-ring rotor has been found by the authors to give satisfactory results. It is necessary to prevent the rotor turning round under the action of the currents, and to provide a fine adjustment for altering the relative positions of the rotor and stator.

The use of a single-phase generator with a single-phase induction motor is not very satisfactory.

Induction phase transformers with suitable connections and rotor-adjusting devices may now be obtained from several makers, and the larger the rated output of the machine the more satisfactory will be the result.

A multiphase choking coil is also a most convenient and satisfactory piece of apparatus if it is properly arranged and of ample dimensions. A combined phase adjuster and voltage regulator of this type has been in use for several years in the test-room of the Manchester Corporation Electricity Department, and has given excellent results.

The main portion of the apparatus consists of an ordinary D.C. drum armature, having a lap winding and slotted core, and originally used in a 10-H.P. four-pole 400-volt motor. The armature has been surrounded with tightly-fitting annealed iron stampings in the form of annular rings, built up to a depth nearly equal to the length of the core, and compressed between strong gun-metal end-rings. Suitable ventilating gaps are provided at intervals, and the bolts drawing the end rings together are bushed to avoid the production of eddy currents. The three-phase supply mains are connected to the armature windings at six equi-distant points, and consequently induce a rotating magnetic field in the armature and annular ring. The magnetic circuit is practically all iron, as the joints are very good.

The armature is mounted with the axis vertical in a stand forming part of a switchboard, and the upper end of the shaft is utilised as the support for a free-fitting bush, on which two radial arms are fitted. These arms may be moved relatively to each other, and may also be clamped together in any required position (fig. 3).

At the ends of the radial arms insulated brush-holder spindles are mounted, to which suitable brush-holders are attached. The brushes are of solid copper, and the portions bedding on the commutator are sufficiently thin to avoid bridging the insulation between segments. This is necessary, as the brushes have to be moved over active segments having an appreciable difference of potential between them. By moving the radial arms relatively to each other, a large range of voltage adjustment may be obtained, and when the arms are clamped together, and the whole combination is moved round the commutator, any desired phase displacement may be obtained between the voltage of the circuit fed from the movable brushes, and that of any other circuit connected to the same source of alternating current as the phase adjuster.

Usually only the two collecting brushes are used, but provision is made for attaching a third. The apparatus also acts as an auto-transformer, and if the brushes are set with an angle of 90° between them, a pressure higher than the supply voltage may be obtained. Any lower voltage may be obtained by moving the brushes nearer together.

The phase adjuster is used to supply the pressure circuits of the meters, the series circuits being fed from the low-voltage (about 20 volts) secondary windings of a step-down transformer, with the primary connected to the same source of supply as the phase adjuster. As both the primary and secondary windings of this transformer are in two sections, it is possible to obtain a fairly constant secondary voltage with a wide range of primary volts.

When the phase adjuster is supplied with three-phase current at 364 volts between lines, the no-load current = 4·45 amperes per phase, and the no-load watts = 428 total.

The adjustments for voltage and phase regulation are necessarily in steps, but a fine adjustment of the voltage is obtained by regulation of the alternator field, and the steps for phase adjustment are sufficiently small for practical purposes. Records taken by the authors with an oscillograph show that even when an appreciable load is taken from the secondary or movable circuit of the phase adjuster, the secondary wave shows no apparent difference in shape from that of the primary wave.

With regard to the method of obtaining certain different phase relations by connecting the series coils of the meters to one part, and the shunt coils to another part of a three-phase supply, it may

be pointed out that the theoretical phase relations are much disturbed by the unbalanced nature of the load. This disturbance is particularly marked when connection is made to the neutral point.

The testing of D.C. meters presents no special difficulties, and the results of the tests carried out by testing authorities are rarely disputed; with A.C. meters, however, when the accuracy is in dispute, questions are raised relating to the voltage, frequency, power factor and wave-form of the testing circuits, and in the case of a polyphase meter, to whether it was tested on a single-phase or a polyphase circuit.

Tests were carried out by the authors on a number of meters of the induction type supplied by different manufacturers, relating to the effects of wave-form and to the methods of testing polyphase meters. The results show that alteration of the shape of the A.C. wave affects the accuracy of the registration of induction meters.

By driving a second alternator at three times the frequency of the first, and connecting the armatures of the two machines in series, the third harmonic was superposed on the fundamental obtained from the movable stator machine. By this means the amplitude and phase of the harmonic could be altered relatively to the fundamental, and the wave was easily maintained when the machines were loaded.

The circuits were so arranged that the change from the fundamental to the mixed wave could be quickly made, and

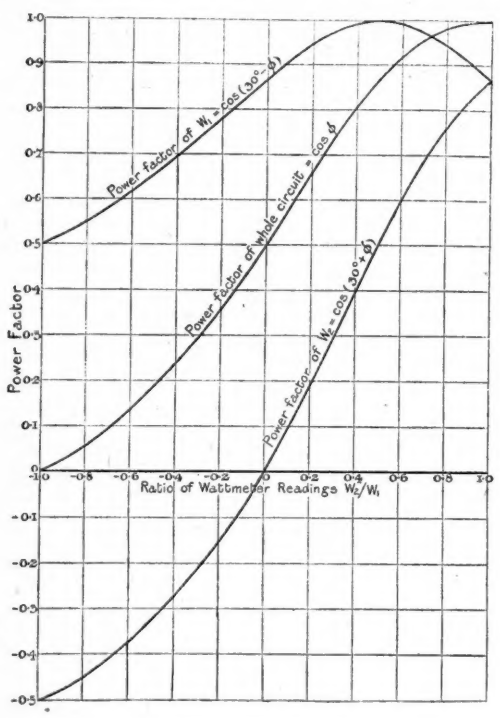

Power Factor
Ratio of Wattmeter Readings W_2/W_1
Power factor of $W_1 = \cos(30° - \phi)$
Power factor of whole circuit $= \cos\phi$
Power factor of $W_2 = \cos(30° + \phi)$

Fig. 4.

the harmonic wave could be reversed so as to produce a peaked or a dimpled wave.

The accuracy of some makes of meters is more seriously affected by change of wave-form than the accuracy of others, but all are seriously affected with some of the waves used.

When the power factor of the circuit is unity the errors increase, in all meters, as the proportion of the harmonic to the fundamental is increased, and the meters register slower.

A meter of the dynamometer type was also tested, and it was found that the errors with the various waves were so small as to come within the limits of errors of observation. The standard indicating wattmeter used for the tests was a Duddell-Mather instrument of the dynamometer type.

Tests have been made on the twin or combination type of polyphase meter, with a common set of integrating dials.

If these meters were perfect, their registrations would represent the total energy of the circuit, independently of the nature of the load, whether balanced or unbalanced, and of the value of the power factor. In order that the meters may register accurately, each of the two single-phase elements of which such meters are composed must be unaffected by the alternating fluxes set up in the other element. It must be remembered that when two single-phase meters are used for measuring the energy in a three-phase three-wire circuit, the phase difference between current and voltage is not the same for both meters. Thus in a polyphase meter, used on a three-phase circuit of unity power factor, each element is connected to a circuit of power factor 0·866, but in one element the current through the series coil is leading the voltage by 30°, while in the second the current is lagging behind the voltage by 30°.

Fig. 4 shows how the power factor of a balanced three-phase load affects the ratio of the watts on the two meters, and also how the equivalent power factor for each meter is affected by the power factor of the load.

Since two single-phase meters may be used to measure the energy, it should be possible to test a polyphase meter by testing each element separately as a single-phase meter, and this method could certainly be adopted if there were no interaction between the two elements. Unfortunately, however, there is always the possibility that the registrations of either of the two elements will not be unaffected by variations due to load on the other. The testing of polyphase meters therefore presents considerable difficulties, and it is, in the authors' opinion, very doubtful whether it is possible to test a polyphase meter so that the result may be relied on to the same degree of accuracy as is the case with a single-phase meter. If the meter cannot be tested as two separate, single-phase meters, it is doubtful whether it can possibly be a true polyphase meter. With the object of clearing up this point, a number of induction type polyphase meters were tested on a three-phase circuit, and on different arrangements of single-phase circuits. The results obtained showed considerable variation in the accuracy of the meters when tested on the various circuits.

In order to determine the effect on the speed of the meter, caused by altering the relative phases of the loads on the two elements, each element was supplied separately with a definite load, one from each of two machines, and, keeping the load on each element constant, a series of observations was taken with the movable stator of one machine in a number of successive positions. The results for two meters of the two-disk type showed that the maximum and minimum speeds of the meter occurred at a difference of phase of 180° between the loads.

In making subsequent tests on other meters for this magnetic interaction, it was found unnecessary to determine curves. The maximum and minimum speeds for a meter were equally well determined by connecting the two current coils in series, and the two pressure coils in parallel with each other respectively, and using one single-phase alternating-current supply. After noting the speed for a particular load, the connections to the current and pressure coils of one element of the meter were reversed, and the speed again noted with the same load.

For the purpose of the authors' investigation, one of the manufacturers kindly made up a special two-disk meter, so arranged that the space between the two elements could be altered at will. With this it was found that when the elements were separated as far as possible, the effect of interaction was about one-half of what it was when the elements were in their normal position. Only one of the meters tested was free from this defect of interaction; but as it was found to be present in other meters of the same type and make, it appears that even the meters of this firm cannot be said to be free from the defect.

When testing one element only of the meter, it is essential to have the pressure coil of the second element excited, because the flux produced thereby acts as a brake flux on the disk, and in actual use both the pressure coils of the meter are excited. The addition of the current flux in the second element will also add to the brake-field. The effect is most marked at the higher loads. It may, however, in some cases be neutralised by the effect of the magnetic interaction previously referred to.

From a testing point of view, especially with meters of large capacity, it is of great importance to be able to test with single-phase current. As has been previously stated, if the meter cannot be tested as a single-phase one, it is doubtful whether it can possibly be a true polyphase meter.

PARLIAMENTARY.

Sidmouth Gas and Electricity Bill.

On March 27th, 28th, 29th and 30th, the Bill promoted by the Sidmouth Gas Co. came before the Earl of Camperdown's Committee of the House Lords. Mr. Freeman, K.C., and Mr. Jeeves were for the promoters, and Mr. Wedderburn, K.C., and Mr. Keen for the Sidmouth Urban District Council.

Mr. Freeman explained that the Bill had for its object the dissolution of the Sidmouth Gas Co. and the incorporation of a new company with a capital of £30,000. They asked that they should be authorised to improve and extend their works and should be empowered to supply electricity for private and public purposes within a certain portion of the limits for the supply of gas. The new capital to be provided was £15,000. The area in which the company was to be authorised to supply electricity was the parish and urban district of Sidmouth. The only opposition came from the Urban District Council, who contended that the proposed dividends were inconsistent with a cheap supply of gas or electricity. They also asked for a clause authorising the purchase by the Council of the undertaking.

A number of local witnesses were called as to the demand for electricity in the district.

Mr. Wedderburn addressed the Committee on behalf of the local authority, and urged that the Bill ought not to be allowed unless a clause was inserted giving the Council the right of purchase. They objected to the electricity clauses, as they submitted that the operations of the company were too small to permit it to carry the burden of an electricity installation without it proving a heavy drain on the gas portion of the undertaking, and would thus prevent the price of gas from being reduced from time to time.

They further considered it would be detrimental to the district that the supply of all the artificial lighting of the district should be in the hands of one company.

The Chairman said the Committee had decided to allow the Bill to proceed, but they wished a suspensory clause inserted, so as to give the Urban District Council the opportunity, if they thought fit, of coming to Parliament next session with a Bill for the purchase of the undertaking. They would not, however, insert a purchase clause in the Bill before them.

On the consideration of clauses, Mr. Wedderburn asked that the electricity powers should be struck out.

The Committee refused to strike out the clause, but inserted a provision to the effect that if the company do not within three years carry out the electricity proposals, there shall be a reduction in the additional capital of £8,000.

The Bill as amended was ordered to be reported to the House.

Central London Railway Bill.

On Wednesday and Thursday last week a Select Committee of the House of Commons, presided over by Mr. Walter Guinness, considered the Bill promoted by the Central London Railway Co. for an extension of the line from Shepherd's Bush to Ealing.

The Hon. J. D. Fitzgerald, K.C., in opening the case for the Bill, said that in place of the exchange station, by means of which which passengers had to pass upstairs and along a passage a considerable length from the Uxbridge Road Station of the Great Western Railway and the Shepherd's Bush Station of the Central London, it was sought to obtain powers to authorise the construction of a very short extension of the Central London line, so as to form a physical junction with the authorised Ealing and Shepherd's Bush Railway of the Great Western Railway. If that were done, passengers from the Great Western would be able to change at Ealing and proceed direct to Liverpool Street when the Central London extension, now in course of construction, was completed next year.

Sir Henry Oakley (chairman of the Central London Railway), replying to Mr. J. D. Fitzgerald, K.C., said that the original scheme of the Great Western Railway was for a subway between the new Shepherd's Bush Station of that line and their station. They were not impressed with that scheme, as they came to the conclusion that it was quite impracticable. In 1907, quite apart from the Great Western Co., they projected a loop which was laid out to Wood Lane, and they made a fresh station there. They found that the existing Wood Lane line was not sufficient for the purposes of the traffic to and from the White City, which had developed to a surprising extent. Part of the present scheme was to enlarge Wood Lane Station. They now ran 420 trains a day in each direction between Wood Lane and the City. Of course, 420 trains would not be wanted between the City and Ealing, but they had agreed that they would run a minimum number of 135 trains a day, so that there might be a good service for the public along the whole line from Ealing to the Bank. Of course, it would be to their interest to make that 135 trains into 150 or 200, if there was traffic for it, but the district had to grow. It was a charming district, and only waited to be built upon, and he had no doubt that a very large and steadily-increasing population would very soon arise there. At the moment, they only proposed to have two stations—one at Ealing Broadway and the other at Acton Halt. Additional stations would come as the population grew. The Acton station would catch the traffic of the Great Western line—that was its object. If a line was constructed with a through route to the Bank he saw no reason why the district should not develop in the same way as it had developed round Golder's Green. He was quite satisfied that the scheme would be a commercial advantage to the Central London Railway. A very small outlay would afford a practical opportunity for a large and growing traffic to come upon their main line, as he might call it, without additional expense—it was not like spending money to carry people all the way to the City. With regard to the opposition of the Metropolitan Railway Co., he considered there would be enough traffic for both companies. The Central London was now carrying about 40 million passengers in the year. There had been a remarkable development of through bookings with other lines. In 1908 some 6,380,000 passengers were exchanged between the Central London and other lines, while in 1910, the number was 7,874,000.

The Chairman said he did not think they need have much more evidence as to the advantage of the line, as the connection considered that to be self-evident.

Cross-examined by Mr. Clode, Witness said he did not see that their scheme would come into practical opposition with the Metropolitan Railway.

Mr. Basil Mott, M.I.C.E., joint engineer to the Central London Railway, with Mr. David Hay, explained that at Wood Lane station it was intended to have two additional platforms for the purpose of coping with the very heavy traffic which they got at exhibition times. The total length of the proposed new line was about ½ mile. It was intended to make a physical junction with the Ealing and Shepherd's Bush Railway, and so enable through working to be carried out between Ealing and Liverpool Street. The total estimate, including land, was £144,896. They had got to go under the Hammersmith and City line of the Metropolitan Railway, but they proposed to give the usual protective clauses, and to carry out the work in conjunction with their engineer. No damage of any sort would be done to the Metropolitan line, and the work would be carried on without interfering with the traffic, as they were prepared to construct the line on the cut and cover system.

Mr. C. Aldington, superintendent of the Great Western Railway, gave evidence in support of the Bill, as did also the Mayor of Ealing.

Mr. R. H. Selbie, the general manager of the Metropolitan Railway, who opposed the Bill, gave evidence in opposition to the scheme. He said that the proposed new route to the City would be much better than that of the existing route by the Metropolitan Co., because passengers would be carried through without having to change. His company opposed the Shepherd's Bush Railway in 1905, and it was on their opposition that an assurance was given that it was not intended to work the line by electricity. He regarded the proposed line as an altogether new element of competition, although he was bound to admit that from a public point of view a through line was more convenient than an exchange station. It was not one of their complaints that they were going to have this more effective competition by the Central London—what they complained of was that they would be left on their system with the inconvenience of exchange. If they could be put in the position of getting a through line for their own traffic, their objection to the scheme would disappear—they would be quite prepared to compete if they could compete on equal terms.

After further evidence had been given in opposition,

The Chairman, in announcing the decision of the Committee, said they found the preamble of the Bill proved, subject to the production of clauses protecting the rights of the Metropolitan Railway, if any should be found to exist under the agreement of 1865. They also wished for the insertion of a clause binding the Central London Railway for a period of five years not to oppose on the grounds of competition any future application to Parliament by the Metropolitan Railway or the Great Western Railway, providing for a junction and through running of trains between the Hammersmith and City line and the Shepherd's Bush and Ealing line. The Committee also wished to put it on record, that although they had not heard any evidence as to the possibilities of a physical connection between the Ealing and Shepherd's Bush and the Hammersmith and City Railways from an engineering point of view, or as to its effect on interests other than those of the Great Western and the Central London Railways, they were of opinion that such a junction would be an advantage to the public, and might compensate the Metropolitan Railway Co. for the competition involved by the through facilities given in the present Bill.

Leadless Glaze.—In the course of a reply to a question by Mr. Steel Maitland concerning the dangers attendant on the use of lead in the Potteries, Dr. Macnamara said that all recent purchases of porcelain insulators, &c., for Admiralty electrical work had been in leadless or low-solubility glaze, and this would be continued if experience showed that there was no sacrifice in durability or efficiency.

Paignton U.D.C. Bill.—On this Bill coming before the Local Legislation Committee of the House of Commons on March 28th, Mr. Keen, for the promoters, stated that the proposals with regard to tramways would be withdrawn. The Bill authorised the local authority to construct a tramway authorised by the Torquay and Paignton Tramways Act of 1909, if the tramway company themselves did not carry out the work. Mr. Keen stated that the difficulties had been got over, and the promoters believed the tramway would now be constructed.

Metropolitan Electric Supply (Acton Purchase) Bill.—Sir Henry Kimber's Select Committee of the House of Commons last week passed the preamble of the Bill promoted by the Metropolitan Electric Supply Co. to confirm an agreement with the Acton District Council for the purchase by the company of the electric lighting undertaking of the local authority.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

TURKEY.—Every invoice presented to the Customs with an import declaration must be original, and must bear the written signature of the foreign selling house or manufactory by whom it has been made out. The signature must certify the authenticity of the invoice in the following form:—

"Nous certifons que cette facture est authentique et qu'elle est la seule emise par notre maison pour les marchandises y mentionnees."

(Signature).

A duty of 11 per cent. *ad valorem* is levied in electrical goods imported into Turkey. This duty is calculated on the market value of the goods in Turkey.

TURKS AND CAICOS ISLANDS.—The following goods are free of duty:—Apparatus and appliances of all kinds for generating, storing, conducting, converting into power or light and measuring gas or electricity; copper rods; railway rolling stock and parts thereof, rails, ties and all materials and appliances to be used exclusively for construction, equipment and operation of railways and tramways; machinery of all

kinds; telegraph and telephone instruments, lines, switch-boards and fittings.

Goods not specially mentioned in the Tariff pay a duty of 10 per cent. *ad valorem* calculated on the value at the place of shipment, without the addition of any shipping or other charges.

No person is allowed to establish or use any apparatus for the purpose of wireless telegraphy without a licence from the Governor-in-Chief.

NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

6,879. "Block circuit for controlling from a distance apparatuses of railway tracks." E. Franchiment and V. Cesar. March 20th. (Complete.)

6,905. "Electrically-controlled presses and the like." S. Atkin. March 20th.

6,909. "Automatic electric switch." A. W. Abbott. March 20th.

6,972. "Construction of automatic lock and switch for lift doors or gates." C. F. Archer. March 20th.

6,983. "Lug joints for the lids of electric accumulator boxes." P. J. Barnes. March 20th. (Complete.)

6,984. "Flame arc lamps or the like." Oliver Arc Lamp, Ltd., C. Oliver and W. M. D. Pell. March 20th.

6,986. "Flame arc lamps or the like." Oliver Arc Lamp, Ltd., C. Oliver and W. M. D. Pell. March 20th.

6,988. "Electric lamps." British Thomson-Houston Co., Ltd., and H. H. Needham. March 20th.

6,996. "Electric tramways motor-controller, back run electric brake." J. Edwards and E. J. Stait. March 21st.

6,997. "Water-cooled starting and regulating resistances." W. W. E. French. March 21st.

7,021. "Cooling the commutators and brushes of dynamo-electric machines." M. J. Railing and A. T. Bartlett. March 21st. (Complete.)

7,045. "Continuous electric current generators with separate excitation." F. Kupp Akt.-Ges. (Convention date, May 18th, 1910.) March 21st. (Complete.)

7,062. "Electrically propelled vessels." D. Balachowsky and P. Caire. (Convention date, March 22nd, 1910, France.) March 21st. (Complete.)

7,092. "Devices for suspending, lowering and hoisting electric and other lamps." Johnson & Phillips, Ltd., and J. Brockie. March 21st.

7,097. "Switches and interrupters for electric circuits." H. R. Schultz. March 21st.

7,104. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 21st.

7,108. "Spark plugs." H. E. Maher. (Convention date, April 28th, 1910, United States.) March 21st.

7,118. "Self-contained automatic electric fire alarm." J. Laxton. March 22nd.

7,148. "Electric boat-hoisting apparatus." J. Fielding. March 22nd.

7,161. "Electric lampholders." L. M. Waterhouse. March 22nd.

7,198. "Trolley bases for electric traction systems." E. M. Munro and Railless Electric Traction Co., Ltd. (Divided application on 11,157/10, May 5th.) March 22nd.

7,220. "Electrical potential regulators." M. Fuss. (Convention date, March 22nd, 1910, Germany). March 22nd. (Complete.)

7,266. "Electric tramcars." S. Gleaves and J. E. Holliday. March 23rd.

7,295. "Apparatus for transforming continuous currents into alternating currents." Ozonair, Ltd., and E. L. Joseph. March 23rd.

7,306. "Electric lamps." W. Curtis. March 23rd.

7,307. "Electric lamps for use in mines and elsewhere." H. J. Read. March 23rd.

7,320. "Resistances for regulating induction motors." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts-Ges., Germany.) March 23rd.

7,341. "Adjustable carrier for gas or electric light reflectors, shades, globes and the like." G. P. Fairless and H. B. Prentice. March 24th.

7,344. "Electric lighting arrangements for billiard tables, shops and the like." H. Mitchell. March 24th.

7,373. "Electric switch of rotatory type for electric light or power purposes, specially designed for railway trains equipped with storage batteries and dynamos." R. W. Birkett and S. E. Thornton. March 24th.

7,386. "Thermo-electric motor." E. E. Rouse. March 24th.

7,395. "Electric arc lamps." W. K.-L. Dickson. March 24th.

7,416. "Time switches for electric lighting." P. Schroder. (Convention date, May 23rd, 1910, Germany.) March 24th. (Complete.)

7,501. "Arc lamps." Siemens-Schuckertwerke G.m.b.H. (Convention date, March 26th, 1910, Germany.) March 25th. (Complete.)

7,504. "Electric condensers." G. Fuller and D. Fuller. March 25th.

7,511. "Device for insulating the twisted ends of electric wires." J. Krannichfeldt. March 25th. (Complete.)

7,519. "Receivers for wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. March 25th.

7,522. "Electric meters and the like." R. S. Hill. March 25th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

Contacts for Contact-Breakers especially Applicable to Inductive Electrical Appliances. E. Turner and G. Fenwick. 30,101. December 24th.

1910.

Receiving Apparatus for Wireless Telegraphy. R. R. Goldthorp. 25,280. October 31st. (October 29th, 1909.)

Electric Switches more especially Suitable for Automatic Telephone Systems. American Automatic Telephone Co. and C. L. Goodrum. 28,057. December 2nd. (Divided application on No. 29,963 of 1909. December 22nd.)

Electrical Impulse Transmitting or Calling Devices for Telephone Systems. S. G. S. Dicker. (Automatic Electric Co.) 29,654. December 21st. (Divided application on No. 1,298 of 1910. January 18th.)

Electrical Transmission Dynamometer. C. V. Drysdale. 4,669. February 24th.

Electric Device for Branding or Stamping Meat. J. A. Jordan. 4,858. February 26th.

Wireless Electric Signalling. R. A. Fessenden. 5,133. March 1st.

Devices for Connecting Telegraph, Telephone, and other Wires or Conductors to their Insulators or Supports. J. Murdoch. (W. M. Robinson.) 5,883.

Processes for Manufacturing Metal Filaments for Incandescent Electric Lamps. A. Lederer and Westinghouse Metal-Filament Lamp Co. 5,388. March 3rd.

Electric Arc Lamps. Jandus Arc Lamp and Electric Co., A. D. Jones and P. V. Castell-Evans. 5,965. March 10th.

Electric Water-Heaters. M. V. Ely and Foster Arc Lamp and Engineering Co. 6,065. March 10th.

Automatic Telephone Exchanges. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 6,654. March 16th.

Prepayment Electricity Meters. W. N. Goddard. 7,587. March 29th.

Electrically-Driven Vehicles. A. F. Batchelder. 8,368. April 7th.

Name Indicators for Telephone Users and like purposes. M. W. Wright. 9,722. April 21st.

Method of and Appliances for Stopping, Starting and Reversing Electrically-Driven Winding and other Gear. J. Hollick. 10,245. April 27th.

Electrostatic Voltmeter. R. B. Burrowes. 10,722. May 2nd.

Holders for Electric Incandescent Lamps. A. Baker and Longstreth's, Ltd. 11,275. May 6th.

Electric Motor Control Systems. British Thomson-Houston Co. (General Electric Co.) 12,265. May 18th.

Arc Lamps. W. R. Ridings. 13,535. July 14th. (Cognate application, No. 15,086 of 1910.)

Process for the Regulation of the Welding Heat in Electric Welding. E. Presser. 15,031. June 22nd. (Addition to No. 14,859 of 1910.)

System of Connection for Electric Welding by Continuous Current and the Use of Condensers. E. Presser. 15,032. June 22nd. (Addition to No. 14,859 of 1910.)

Central Energy Electrical Signalling System. A. Goldstein. 16,836. July 8th.

Electric Arc Lamp for Two or more Pairs of Electrodes. A. Schwarz. 16,941. July 14th.

Machines for Running Fish Wires through Electric Conduits and the like. W. H. Lake. 17,165. March 2nd.

Electrically-Actuated Brakes. W. Cross. (F. Krizik.) 17,597. July 25th.

Holder for Electric Incandescent Lamps. G. Weissmann. 18,738. August 9th.

Electric Heating and (or) Cooking Stoves. O. C. Hawkes. 19,466. August 19th.

Apparatus and Process for Making Wire Electrolytically. W. G. Gibbs. 19,593. August 22nd.

Process and Apparatus for Electrodeposition. S. Consigliere. 20,776. September 6th.

Inductive Wireless Telephone Installations. H. von Kramer. 21,451. September 15th.

M.S.U.A. Annual Report.—The annual memorandum of the chief engineer of the Manchester Steam Users' Association for 1909 contains some notes on coal and smoke which would possibly have been better had they been more expanded. The argument which appears to be enforced is that, if boiler-owners are too keenly urged to prevent smoke, they will do so by adopting means to prevent it which will reduce the efficiency of combustion, and more coal will be burned, and that worst evil of coal combustion, the sulphur fumes, will be increased. This really amounts to a plea for the continuance of present types of furnace. It would be better to point out why smoke is made by present forms of furnace; where these furnaces fail in principle; what has been and is being done in the soft-coal regions of America to remedy matters; what has already been done in London. The burning of bituminous coal is a proceeding that admits of rational explanations. If burned unscientifically, much smoke will be made; if burned properly in furnaces of good form, there will be little or no smoke. Of course, it is not the black smoke that is the worst evil; at least, the habit has grown up of saying this. But if we cannot abolish the sulphur, why need we cling to the filthy blackness? Soot is disfiguring; if we could abolish soot, we should save tens of thousands annually in clothes and washing. If soot were to be abolished, the ruin of buildings which sulphur effects would become more obvious, though less severe, and attention would be called visibly to the evil which is now often hidden beneath a cloak of sooty filth.

It is curious to learn that if mild steel subject to tensile stresses be brought into contact with caustic soda it becomes quite brittle. This strange fact has never been explained, though, doubtless, it soon may be if research be made into the phenomenon by a few qualified chemists.

Attention must also be drawn to the dangers that attend the removal of manhole covers unless there is previously an actual free communication between the atmosphere and the interior of the boiler. It is not merely sufficient to prop up a safety valve lever; this does not necessarily lift the valve. Every wise attendant will prove absolutely that there is such free communication before he loosens a bolt. An ounce of pressure may scald a man fatally—indeed, less than this small pressure may produce a scalding outrush of steam. Boilers of old had inwardly opening valves to destroy possible internal vacuum of a cold boiler. Modern boilers will not thus collapse, but a boiler with internal vacuum and a manhole cover opening inwards is most dangerous, for in will go the cover and the air rush may drag a man through the hole and kill him. A steam boiler is a pretty dangerous object. It is more dangerous "empty" than when in work, for nobody but a specialist suspects an empty boiler; we are all suspicious of the full ones. Yet an empty, or more than empty boiler, like an alleged "unloaded" rifle, is or may be a very mine of mischief, to be regarded with the keenest suspicion.